Non-pharmacological interventions for breathlessness in advanced stages of malignant and non-malignant diseases (Review)

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TABLE OF CONTENTS

[Intervention Review]

Non-pharmacological interventions for breathlessness in advanced stages of malignant and non-malignant diseases

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Editorial group: Cochrane Pain, Palliative and Supportive Care Group.
Publication status and date: Edited (no change to conclusions), published in Issue 3, 2011.
Review content assessed as up-to-date: 4 February 2008.

Citation: Bausewein C, Booth S, Gysels M, Higginson IJ. Non-pharmacological interventions for breathlessness in advanced stages of malignant and non-malignant diseases. *Cochrane Database of Systematic Reviews* 2008, Issue 2. Art. No.: CD005623. DOI: 10.1002/14651858.CD005623.pub2.

ABSTRACT

Background

Breathlessness is a common and distressing symptom in advanced stages of malignant and non-malignant diseases. Appropriate management requires both pharmacological and non-pharmacological interventions.

Objectives

Primary objective was to determine effectiveness of non-pharmacological and non-invasive interventions to relieve breathlessness in participants suffering from the five most common conditions causing breathlessness in advanced disease.

Search methods

The Cochrane Central Register of Controlled Trials, MEDLINE, EMBASE, CINAHL, British Nursing Index, PsycINFO, Science Citation Index Expanded, AMED, The Cochrane Pain, Palliative and Supportive Care Trials Register, The Cochrane Database of Systematic Reviews, and Database of Abstracts of Reviews of Effectiveness were searched in June 2007.

Selection criteria

We included randomised controlled and controlled clinical trials assessing the effects of non-pharmacological and non-invasive interventions to relieve breathlessness in participants described as suffering from breathlessness due to advanced stages of cancer, chronic obstructive pulmonary disease (COPD), interstitial lung disease, chronic heart failure or motor neurone disease.

Data collection and analysis

Two review authors independently assessed relevant studies for inclusion. Data extraction and quality assessment was performed by three review authors and checked by two other review authors. Meta-analysis was not attempted due to heterogeneity of studies.

Main results

Forty-seven studies were included (2532 participants) and categorised as follows: single component interventions with subcategories of walking aids (n = 7), distractive auditory stimuli (music) (n = 6), chest wall vibration (CWV, n = 5), acupuncture/acupressure (n = 5), relaxation (n = 4), neuro-electrical muscle stimulation (NMES, n = 3) and fan (n = 2). Multi-component interventions were categorised in to counselling and support (n = 6), breathing training (n = 3), counselling and support with breathing-relaxation training (n = 2), case management (n = 2) and psychotherapy (n = 2).

There was a high strength of evidence that NMES and CWV could relieve breathlessness and moderate strength for the use of walking aids and breathing training. There is a low strength of evidence that acupuncture/acupressure is helpful and no evidence for the use of music. There is not enough data to judge the evidence for relaxation, fan, counselling and support, counselling and support with breathing-relaxation training, case management and psychotherapy. Most studies have been conducted in COPD patients, only a few studies included participants with other conditions.

Authors' conclusions

Breathing training, walking aids, NMES and CWV appear to be effective non-pharmacological interventions for relieving breathlessness in advanced stages of disease.

PLAIN LANGUAGE SUMMARY

Non-pharmacological interventions for use in breathlessness in the advanced stages of malignant and non-malignant diseases

Shortness of breath is a common and distressing symptom in incurable cancer and some other illnesses at the end of life. Overall shortness of breath towards the end of life is still difficult to treat. Appropriate treatment of this distressing symptom requires both drug and non-drug methods. We aimed to determine which non-drug methods relieve shortness of breath and which are the most effective. We found 47 studies that were first categorised in to two groups: methods with one clear described component and methods with a mixture of components. The two groups were then divided in to 12 subgroups. The following studies showed that these interventions can help to relieve shortness of breath: vibration of patient's chest wall, electrical stimulation of leg muscles, walking aids and breathing training. There are mixed results for the use of acupuncture/acupressure. Further interventions identified were counselling and support, either alone or in combination with relaxation-breathing training, music, relaxation, a hand-held fan directed at a patient's face, case management and psychotherapy. There are several non-drug methods available to relieve shortness of breath in incurable stages of cancer and other illnesses. There is currently not enough data to judge the evidence for these interventions. Most studies were conducted in participants with chronic lung disease. Only a few studies included participants with heart failure, cancer or neurological disease.

BACKGROUND

Breathlessness or dyspnoea is defined as "a subjective experience of breathing discomfort that consists of qualitatively distinct sensations that vary in intensity" (ATS 1999). Breathlessness is a common symptom in advanced stages of malignant and non-malignant diseases. Many patients with different conditions including primary and secondary cancer, chronic obstructive pulmonary disease (COPD), cystic fibrosis, cryptogenic fibrosing alveolitis/interstitial lung disease (ILD), chronic heart failure (CHF) or motor neurone disease/amyotrophic lateral sclerosis (MND/ALS) can suffer from this distressing symptom (Bruera 2000; Chang 1999; Nordgren 2003; Skilbeck 1998; Solano 2006). Breathlessness is a multifactorial and complex symptom and an experience unique to the individual (Nicholls 2000). The terms dyspnoea, breathlessness and shortness of breath are used interchangeably in the literature (Carrieri 1984).

The 'advanced' stage of a disease is often not clearly defined. Generally the term 'advanced' is connected with active and progressive disease and a limited prognosis. Prognosis in advanced disease relates to different factors such as symptoms, performance status and disease trajectory. As disease trajectories vary depending on whether the patient is suffering from malignant or non-malignant disease (Murray 2005) advanced stages have to be defined independently for every disease. Breathlessness is known to be one of

the symptoms that increases as death approaches in cancer patients (Heyse-Moore 1991; Lutz 2001; Reuben 1986), in COPD (Lynn 2000) and in MND (Voltz 1997).

Management of breathlessness

Overall breathlessness is still difficult to manage. Appropriate management to relieve breathlessness in advanced disease requires both pharmacological and non-pharmacological interventions. The evidence for the different treatment options varies. Several Cochrane Reviews and other authoritative systematic reviews have been published over the last few years (Booth 2004; Cranston 2004; Jennings 2001; Polosa 2002; Ram 2002). Opioids play an important role for symptom relief of breathlessness. However, the use of nebulised opioids cannot be recommended as the studies analysed showed no significant difference (Jennings 2001). This latter finding is supported by Polosa's review for patients with interstitial lung disease (Polosa 2002). Benzodiazepines are often recommended to relieve panic attacks and anxiety in patients with breathlessness, however, there is no evidence available about the benefit of these drugs in patients with advanced disease. One systematic review shows convincing evidence for the use of oxygen in patients with breathlessness at rest and some evidence that patients experience less breathlessness during exercise than when receiving oxygen (Booth 2004). In patients with COPD the available evidence does not allow any firm conclusions concerning the effectiveness of ambulatory domiciliary oxygen therapy (Ram 2002). A Cochrane review on oxygen therapy for dyspnoea in chronic terminal illness is underway (Cranston 2004). In consequence, pharmacological interventions alone often do not relieve breathlessness adequately and patients are left with distressing symptoms. Furthermore the use of drugs to treat breathlessness are sometimes limited as they cause adverse effects and doses need to be titrated carefully.

Non-pharmacological interventions

Non-pharmacological interventions may complement pharmacological interventions and may offer alternative treatment options in the management of breathlessness both in earlier stages of the disease and also in the management of advanced illness. Pulmonary rehabilitation for patients with COPD has been shown to relieve dyspnoea and fatigue, improve emotional function and enhance a patients' sense of control over their condition (Lacasse 2006). Solà et al showed that nurse follow-up programmes and nurse interventions to manage breathlessness may produce beneficial effects in patients with lung cancer (Sola 2004). However, the focus of the latter review was the evaluation of studies looking at patients' well-being and not breathlessness itself. Non-invasive and invasive ventilation play a major role in patients with MND and evidence-based recommendations have been published to support the management of MND and related breathlessness (Heffernan 2006). In patients with COPD bilevel non-invasive positive pressure ventilation improved breathlessness and health related quality of life (Kolodziej 2007). However, there is a variety of non-pharmacological interventions besides rehabilitation and non-invasive ventilation for patients with breathlessness such as nursing interventions, relaxation techniques or complementary therapies. These could offer appropriate palliation and could benefit those whose quality of life may be seriously impaired by their condition. However, the evidence for these treatment options is unclear.

OBJECTIVES

The primary objective of this review was to determine the effectiveness of non-pharmacological and non-invasive interventions to relieve breathlessness in patients suffering from the five most common conditions (primary and secondary cancer, COPD, ILD, CHF or MND) causing breathlessness in advanced disease.

Secondary objectives were to find out which intervention strategies are available, which are the most effective and which groups of participants benefit most from which intervention.

METHODS

Criteria for considering studies for this review

Types of studies

Randomised controlled trials (RCTs).
Controlled clinical trials (quasi-randomised trials, trials with double-blinding but randomisation not mentioned).

Types of participants

Adult participants described as suffering from breathlessness or dyspnoea or shortness of breath or difficulty breathing or laboured breathing due to advanced stages of diseases with a high prevalence of breathlessness such as primary or secondary lung cancer, COPD, ILD, CHF or MND.
The inclusion criteria for advanced disease were as follows in the individual diseases:

- participants suffering from cancer should have advanced local or metastatic disease and should have completed disease orientated treatment such as chemotherapy, radiotherapy or surgery;
- participants suffering from severe COPD should have a FEV_1 of less than 50% predicted (forced expiratory volume in 1 second, the FEV_1 is the volume exhaled during the first second of a forced exhalation);

- participants suffering from CHF should have a NYHA (New York Heart Association) stage III or IV;
- any participants with ILD as breathlessness is the most prominent and disabling symptom in this incurable disease;
- any participants with MND complaining of breathlessness as they have a limited prognosis when developing breathlessness as there are no specific treatment options to influence the course of this disease.

The cut-off point of the individual participant groups was 25%, i.e. at least 25% of the study population fell in to the stages outlined above. This cut-off point was chosen to ensure that no conclusions were drawn which were referring to participants with earlier stages of disease. Included participants could be in any setting. Studies regarding participants with any conditions not regarded as progressive, refractory to treatment and advanced e.g. as acute or chronic asthma were not included in the review.

Types of interventions

(1) Non-pharmacological interventions: any interventions that were not classified as medicinal products (according to EU Directive 2001/83/EEC "any substance or combination of substances which may be administered to human beings or animals with a view to making a diagnosis or to restoring, correcting or modifying physiological function in human beings or animals is likewise considered a medicinal product"). Oxygen was considered to be a medicinal substance and was not covered in this review.
(2) Non-invasive interventions: we excluded studies examining any invasive interventions such as surgical procedures, drainage, tapping, endoscopy and catheterisation. We included acupuncture in the review as it is a complementary therapy rather than an invasive treatment.
We excluded the following non-pharmacological interventions as there have been recent Cochrane Reviews, other reviews or Cochrane Reviews are on the way: pulmonary rehabilitation (Lacasse 2006), non-invasive ventilation (Wijkstra 2002), nutritional supplementation (Ferreira 2005), oxygen (Cranston 2004), self-management education (Effing 2007), and exercise (Puhan 2005).
Interventions were compared against placebo or usual therapy.

Types of outcome measures

Primary outcomes

- Subjective measures of breathlessness on validated and reliable scales such as visual analogue scales (VAS), numerical rating scales (NRS), categorical scales, modified Borg scales.
- If subjective measures were not present, breathlessness specific scales or disease specific scales were defined as a primary outcome.

Secondary outcomes

- Domain specific measures for depression and anxiety.
- Quality of life measured by validated and reliable instruments.
- Participants satisfaction with the treatment.
- Adverse-effects.
- Participants withdrawal from the studies.

Search methods for identification of studies

Electronic searches

Electronic databases searched (access via OVID)

MEDLINE (1966 to May, week 5, 2007)
EMBASE (1980 to week 23, 2007)
CINAHL (1980 to June 2007)
British Nursing Index (1985 to May 2007)
PsycINFO (1985 to June, week 1, 2007)
Science Citation Index Expanded (1985 to June 2007)
AMED (Allied and Complementary Medicine) (1985 to June 2007)
Cochrane Pain, Palliative and Supportive Care Trials Register (June 2007)
Cochrane Database of Systematic Reviews (CDSR) (June 2007)
The Cochrane Central Register of Controlled Trials (CENTRAL) (June 2007)
Database of Abstracts of Reviews of Effectiveness (DARE) (June 2007)
The MEDLINE search strategy which was adapted for other databases searched for this review can be seen in Appendix 1.

Searching other resources

Handsearching

The reference lists of all relevant studies were checked for further studies. Several reviews on the subject were read and the reference lists checked (Booker 2005; Bruton 2005; Bullock 1997; Carrieri-Kohlman1993; Carrieri-Kohlman2006; Coats 2005; Cowcher 1990; Dechman 2004; Ernst 2001; Gallo-Silver 2000; Hartmann 1988; Hoyal 1982; Kerr 1989; Kohlman 1986; Luce 2001; Marcus 2003; O'Rourke 2007; Pan 2000; Rosser 1981; Taylor 2005; Taylor 2007; Ziment 2003).
The reference list of the following textbooks were handsearched: Oxford Textbook of Palliative Medicine, Textbook of Palliative Nursing, Dyspnea in Advanced Disease, Supportive Care in Respiratory Disease, Palliative Care in Non-Cancer Patients, Palliative Care in Amyotrophic Lateral Sclerosis, "Dyspnea:

A 3-in-1 medical reference". Furthermore the following websites were searched: www.caresearch.com.au, www.cam.org.nz (Complementary and alternative medicine), www.controlled-trials.com (Current controlled trials), www.rccm.org.uk/ciscom/CISCOM_intro.aspx (CISCOM Centralised information service for complementary medicine), www.chernydatabase.org.

Personal contact

The following authors of main studies and investigators known to be carrying out research in this area were contacted to find out about any unpublished data or grey literature: Sam Ahmedzai, Eduardo Bruera, Virginia Carrieri-Kohlman, Jessica Corner, David Currow, Carol Davies, Deborah Dudgeon, Edzard Ernst, Andrew Wilcock.

Language

There was no language restriction in the selection of studies.

Data collection and analysis

Selection of studies

Two review authors (CB, SB) assessed titles for relevance identified by the searches. The abstracts of potential studies identified by this process were then checked and the full text of all potentially relevant studies were obtained and assessed by three review authors.

Assessment of methodological quality of included studies

Each of the selected studies were assessed independently by three review authors for methodological quality. The Oxford Quality Scale was used to check for the use of randomisation, double-blinding and description of withdrawals and dropouts (Jadad 1996). The maximum score of the Oxford Quality Scale is five. A score of three is judged as 'high quality', a score of two or less as poor quality. The Oxford Quality Scale has been criticised for being of limited use e.g. as considerable importance has been given to blinding but this may not be feasible in many studies (Jüni 2005). Therefore we also graded the papers according to the "Method Score" from Edwards 2003. This checklist for methodological quality contains 11 items which assess the primary research quality of the studies and its published description. The following items were assessed and scored zero, one or two for adequacy: definition of aims; sample formation; description of inclusion and exclusion criteria; description of subject characteristics; power calculation; objectivity of outcome measures used; adequacy of follow-up; adequacy of analysis (intention to treat); adjustment for baseline differences between groups; appropriate unit of allocation to groups; randomization method. A total method score was then constructed and the overall quality of the studies rated as follows: low (12 and under), medium (13 to 14), high (15 and over) (Edwards, personal communication). The grade of evidence was assessed using a standard system which has been used in the Palliative Care National Institute of Clinical Excellence (NICE) guidelines (Gysels 2004). See additional Table 1.

Grading the strength of the evidence

The body of evidence was graded for each category after assessment of the quality of individual studies. We adopted a scale that incorporates the outcomes and quality of studies and determines three overall grades of the strength of evidence: high, moderate, low (Ebell 2004; Gomes 2006; Hoogendoorn 2000). High strength evidence was given when a minimum of three high quality studies existed which had performed multivariate analysis and > 70% of studies had reported similar findings; moderate strength evidence was assigned when either a minimum of three high quality studies reported < 70% similar findings or a minimum of three medium quality studies existed and >50% of studies reported similar findings. All other cases were considered as low strength of evidence.

Data extraction

Three review authors (CB, MG, FM) extracted the data of relevant studies independently in a data extraction form designed for this review. One review author (CB) cross-checked the data extracted. Data extracted included information on study design, type of intervention/control, outcome measures, main results of the study, number of withdrawals and dropouts, adverse effects of the intervention, follow-up, health care cost and participants' comments on interventions. Two other review authors (IJH, SB) checked a random sample of the studies that were assessed which the other three review authors had assessed previously. Any disagreements were resolved by discussion between the review authors.

Categorization of studies

After data from relevant studies was extracted, studies were categorised in to two groups with 12 subgroups. Subgroups were arranged according to different interventions. Data from each subgroup was organised by being entered in to an excel spreadsheet.

Heterogeneity

Despite categorization of studies most groups remained too heterogeneous with regards to the diversity of interventions assessed and outcome measures to perform meta-analysis. Therefore we present a narrative synthesis of the various groups and interventions.

RESULTS

Description of studies

See: Characteristics of included studies; Characteristics of excluded studies.

One review author (CB) ran the literature search in March 2006 and re-ran it in June 2007. Overall, the literature search yielded 5100 references. Through the search of textbooks and websites another 54 references were added. Three thousand six hundred and sixty-nine references remained after de-duplication of which 3503 were excluded. The remaining 166 references were assessed in more detail (either abstract or full text). Of these 38 studies were initially included in the review. A further 12 references were retrieved from reference lists of the already identified studies and of various reviews on the subject. One submitted conference abstract (Galbraith 2007) was included. Finally 47 studies published in 51 papers fulfilled the inclusion criteria and were included in the review. These studies were categorised in to single- and multi-component interventions and then in to 12 subgroups. In total 49 studies were excluded. The reasons for exclusion are listed in the 'Characteristics of excluded studies' table.

Categories of non-pharmacological interventions

Single-component intervention

1. Acupuncture/Acupressure

Five studies: three acupuncture (109 participants); two acupressure (75 participants) (Jobst 1986; Lewith 2004; Maa 1997; Vickers 2005; Wu 2004)

2. Distractive auditory stimuli (music)

Six studies (135 participants) (Bauldoff 2000; Bauldoff 2002; Bauldoff 2005; Brooks 2003; Pfister 1998; Sidani 2004)

3. Relaxation

Four studies (238 participants) (Gift 1992; Louie 2004; Renfroe 1988; Yu 2007)

4. Walking Aids

Seven studies (202 participants) (Crisafulli 2007; Dalton 1995; Gupta 2006a; Gupta 2006b; Honeyman 1996; Probst 2004; Solway 2002)

5. Chest wall vibration

Five studies (97 participants) (Cristiano 1997; Fujie 2002; Lange 2006; Nakayama 1998; Sibuya 1994)

6. Neuromuscular electrical stimulation

Three studies (50 participants) (Bourjeily-Habr 2002; Neder 2002; Vivodtzev 2006)

7. Fan

Two studies (66 participants) (Baltzan 2000; Galbraith 2007)

Multi-component interventions

1. Counselling and support

Six studies (1127 participants) (Goodyer 1995; Hermiz 2002; Ketelaars 1998; McMillan 2007; Moore 2002; Rea 2004)

2. Counselling and support with breathing-relaxation training

Two studies (153 participants) (Bredin 1999; Corner 1996)

3. Breathing training

Three studies (129 participants) (two pursed-lip breathing, one breathing techniques) (Garrod 2005; Hochstetter 2005; Wu 2006)

4. Case management

Two studies (156 participants) (Egan 2002; Rabow 2004)

5. Psychotherapy

Two studies (85 participants) (Eiser 1997; Rosser 1983)

Single-component interventions

1. Acupuncture/Acupressure

In this category five studies were included: three on acupuncture (in two studies acupuncture was followed by acupressure studs) (Jobst 1986; Lewith 2004; Vickers 2005) and two on acupressure (Maa 1997; Wu 2004).

Jobst 1986 tested traditional Chinese acupuncture versus placebo (sham) acupuncture in a RCT given over three weeks on 13 occasions in COPD participants. Breathlessness was measured on the Borg scale and the Oxygen Cost Diagram at baseline and after three weeks. It has to be noted that Jobst reversed the usual order

of the Borg scale with 0 = worst and 10 = best. Another single-blind, randomized study with cross-over design evaluated a standardized acupuncture technique followed by two indwelling studs placed into sternal points in a group of participants with lung disease (predominantly COPD) (Lewith 2004). Mock Transcutaneous Electrical Nerve Stimulation (TENS) applied on the same points where acupuncture is normally used was the placebo. Each participant received six treatments in each phase with a two week washout period. Breathlessness was measured on a daily VAS at baseline, during first treatment, at wash-out and during the second treatment. The St. George's Respiratory Questionnaire (SGRQ) was administered at the beginning of the study, at the end of each of the two three-week treatment periods.

A single session of acupuncture or placebo acupuncture was followed by true or placebo acupressure (with acupressure studs) in Vicker's study on cancer participants (Vickers 2005). True points for acupuncture and acupressure were chosen on the basis of prior cases and points traditionally used for breathlessness. Placebo points were chosen in body areas away from true acupuncture points. Participants were asked to apply pressure to the studs by making small circular movements with fingers (two to three cycles per second for one to two minutes per point). Measurement was taken on a NRS every 15 minutes for 75 minutes immediately before and one hour after acupuncture.

Maa 1997 used acupressure (seven acupoints derived from the acupressure literature) versus sham acupressure (seven points not documented in the literature) in a single-blind pretest-posttest cross-over design in COPD participants beginning a 12-week pulmonary rehabilitation programme (Maa 1997). Participants were instructed to apply gentle but firm pressure to the acupoint using one or two fingers to produce a sense of balance between pain and pleasure at least once per day or whenever they had symptoms or wished to do so. A Borg score, a VAS and the Bronchitis Emphysema Checklist were administered pre- and post-intervention during weeks one, six and 12.

In the second acupressure study COPD participants were randomly assigned either to true acupoint acupressure or to a s sham group (Wu 2004). Both groups received five sessions per week (16 minutes per session) over four weeks for a total of 20 sessions. This study was published twice with different outcome measures (Wu 2004). In the first paper data from a VAS was published whereas in the second paper data came from the Pulmonary Function Status and Dyspnoea Questionnaire. Both measures were taken pre-and post-intervention.

2. Distractive auditory stimuli (music)

In a feasibility study Bauldoff 2000 tested whether distractive auditory stimuli (DAS) in the form of music would decrease symptoms in COPD participants when applied to a walking programme after completion of pulmonary rehabilitation. DAS was applied with audiocassettes offering four music options (pop, country, big band and classical with 80 to 100 beats per minute) (Bauldoff 2000). Breathlessness was measured on the University of California St. Diego Shortness of Breath Questionnaire (UCSD-SOB), the Borg scale and a six-minute walking test (6MWT) at baseline and after four weeks. In the second study Bauldoff 2002 aimed to determine whether DAS could facilitate adherence to a walking regimen following completion of pulmonary rehabilitation in COPD participants and thereby maintain what had been achieved during the programme. The groups were instructed to walk at their own pace for 20 to 45 minutes two to five times a week either using DAS with a portable audiocassette player or without DAS. VAS, Borg scale, UCSD-SOB and a 6MWT were used as outcome measures at baseline, after four and eight weeks (Bauldoff 2002). The same authors conducted a third trial in COPD participants using DAS during an upper extremity programme to test whether perceived breathlessness measured on the UCSD-SOB, functional performance and health-related quality of life improved (Bauldoff 2005). Participants where instructed to perform upper extremity training (six-minute peg and ring board count) for up to 15 minutes three to five times a week using either slow (60 to 89 beats per minute) or moderate DAS (90 to 120 beats per minute). The control group received the same instructions but no DAS (Bauldoff 2005). The UCSD-SOB was taken at baseline and after four weeks.

Brooks 2003 examined the effects of music on dyspnoea and anxiety in a cross-over study in COPD participants. After taking a 6MWT to induce breathlessness participants walked ten minutes without music and ten minutes with music (tape recorder with Baroque music) in a randomised order in the participants' homes. Measures (Borg scale) were taken at baseline (before 6MWT), pre-test and ten minutes post-test.

Pfister 1998 tested the effects of music on exercise tolerance (distance walked) and perceived symptoms measured on a Borg scale in COPD participants. In a cross-over design two six-minutes treadmill walks were performed by the participants with and without music. Subjective assessment of perceived effort and dyspnoea were obtained at the start of the test and every minute during the exercise.

In a pilot study Sidani 2004 explored whether resting or resting with music helped reduce dyspnoea and anxiety in COPD participants. A one-group cross-over design was chosen where participants were first asked to take a 6MWT to induce dyspnoea followed by either resting only or resting with music for 20 minutes. Music with a slow tempo (60 to 72 beats per minute) was chosen and participants selected their preferred type of music. The Borg scale was taken at baseline, pre- and post-test. The influence of unguided imagery was examined through a questionnaire on mental activities and perception of the music during the 20-minutes resting period.

3. Relaxation

Gift 1992 tested the effectiveness of a pre-recorded taped progres-

sive relaxation message for tension-release in 16 muscle groups in four weekly sessions with home practice to reduce breathlessness and anxiety in COPD participants. The control group sat quietly for 20 minutes. Anxiety and breathlessness were measured on a VAS at the beginning and at the end of the fourth session (Gift 1992).

The effect of progressive muscle relaxation (PMR) on breathlessness and anxiety was studied by Renfroe 1988. PMR was offered to COPD participants in four weekly sessions plus daily home practice with taped instructions. The control group was instructed to relax for 45 minutes. Dyspnoea was measured on a VAS during each session and at the end of four weeks. Yu tested the effects of relaxation on psychological distress and symptom status in Chinese participants suffering from CHF with PMR training offered in two training sessions, one revision workshop and twice-daily home practice and biweekly telephone follow-up over 14 weeks (Yu 2007). The control group received attention through regular phone calls. Breathlessness was measured on the Dyspnoea and Fatigue subscale of the CHF Questionnaire at baseline, after eight and 14 weeks.

The effects of guided imagery relaxation delivered with a relaxation tape were tested in six practice sessions in COPD participants compared to quiet rest (Louie 2004). Anxiety-induced physiological symptoms (heart rate, skin temperature, oxygen saturation) and breathlessness measured on a Borg scale were assessed before and after the seventh session.

4. Walking aids

There are various walking aids available to help participants such as walking sticks, wheeled walkers which are nowadays called rollators or a wheeled cart to carry something. All studies in this category but one (Gupta 2006b) were conducted as a cross-over design where every participant tested the intervention versus the control in random order. In all studies an unaided walk was used as a control.

Dalton 1995 tested a walking stick and a wheeled walker in a 6MWT. Honeyman 1996 also tested a wheeled walker in a 6MWT on two separate days at the same time of the day. Both studies measured breathlessness at the beginning and end of each walk.

In Solway's study the short-term effects of a rollator on breathlessness and functional exercise capacity were examined in a 6MWT. The test order was randomized on the first day and reversed on the second day (Solway 2002). Measurements were taken at the end of the 6MWT.

Probst et al analysed the effects of a rollator on symptoms during a 6MWT, walking distance and physiologic parameters (Probst 2004). Breathlessness was measured at the end of the 6MWT.

To test whether the effects of a rollator were consistent over time Gupta tested the rollator in 6MWT at baseline, after four and eight weeks (Gupta 2006a). The same group also evaluated the influence of a rollator on health-related quality of life (Gupta 2006b). Breathlessness was measured in both studies at baseline, after four and eight weeks. A different wheeled walking aid was tested by Crisafulli 2007 where COPD participants needing oxygen transported their canister on a small wheeled cart compared to carrying the oxygen canister on the shoulder. 6MWT were randomly performed on two consecutive days and measures taken at baseline and after 6MWT.

All these studies were conducted in COPD participants. Unaided or unassisted walk were used as controls in all studies in this category. All studies used a modified Borg scale as an outcome measure, only one study (Gupta 2006b) used the Chronic Respiratory Disease Questionnaire (CRQ).

5. Chest wall vibration (CWV)

Lange 2006 compared MND participants with respiratory symptoms receiving high-frequency chest wall oscillation over 12 weeks with an untreated group. Participants used an inflatable vest connected to an air pulse generator which in- and deflates the vest twice a day for ten to 15 minutes. Breathlessness was measured on a modified Borg scale, the ALS-Functional Rating Scale and the Baseline/Transition Dyspnoea Index after 12 weeks.

The following studies all had cross-over designs. Sibuya 1994 evaluated in-phase CWV versus out-of-phase CWV in participants with COPD and sequelae of tuberculosis. In both groups two vibrators were attached bilaterally on the second and third interspaces in the parasternal region of the upper chest wall. Two additional vibrators were attached bilaterally at the seventh to ninth interspaces anterior to the midaxillary line in the lower chest wall. Breathlessness was measured on a VAS every minute during five-minute vibration.

In-phase CWV was applied with two standard physiotherapy vibrators, manually triggered during inspiration in nine participants with emphysema and one with bronchiectasis (Cristiano 1997). They were applied bilaterally over the second and third intercostal spaces in the parasternal position. Breathlessness was induced either through steady-state hypercapnia or exercise on a lower extremity cycle ergometer. Measurements were taken in the last ten seconds during each 30 second vibration.

In another study in-phase CWV was evaluated during arm elevation in a cross-over RCT (Nakayama 1998). Participants were asked to keep their arms straight above their head while holding weights (1 to 1.5 kg) for three minutes. Two upper vibrators were attached bilaterally at the second or third intercostal spaces in the parasternal region, vibrating during the inspiratory phase, and two lower vibrators, were attached bilaterally on the anterior axillary lines at the seventh to ninth intercostal spaces, vibrating during expiratory phase. Breathlessness was measured on a modified Borg scale at rest and after three minutes arm exercise.

Fujie tested the effects of CWV in a cross-over RCT during exercise in COPD participants (Fujie 2002). Two vibrators were attached bilaterally at the second or third intercostal spaces in the paraster-

nal region, and two other vibrators were similarly attached at the seventh to ninth intercostal spaces anterior to the midaxillary line. The two pairs of vibrators were synchronized in accordance with the respiratory phase. The vibration (100 Hz) was automatically reversed according to the respiration phase. The upper vibrators were triggered to run during inspiration, and the lower vibrators were triggered to run during expiration. A Borg scale was used for measuring breathlessness at the end of the exercise test.

6. Neuromuscular electrical stimulation (NMES)

Neuromuscular electrical stimulation was tested in participants with severe COPD at home (Neder 2002). A portable, user friendly, dual channel NME stimulator was applied on each quadriceps femoris (15 minutes in the first week and 30 minutes thereafter), in sequence, five times per week for six weeks. Breathlessness was measured with the CRQ at baseline and after six weeks.

Bourjeily-Habr applied NMES to each quadriceps, hamstring and calf muscle in COPD participants (Bourjeily-Habr 2002). Electrical stimulation was performed for 20 minutes on each limb, three days/week for six continuous weeks on an outpatient basis. Breathlessness was measured at baseline and after six weeks on a Borg scale and on an incremental shuttle walk.

Vivodtzev 2006 examined the effects of electrical stimulation on the quadriceps muscles in combination with pulmonary rehabilitation in participants with severe COPD and a low body mass index. Participants received quadriceps electrostimulation in 16 sessions over four weeks for > 30 minutes on both legs simultaneously. Measurements were taken on the 28-item Maugeri-Foundation Respiratory Failure Questionnaire and the modified Borg score at baseline and after four weeks.

7. Fan

Baltzan 2000 used a fan in a cross-over trial blowing on the face during a controlled treadmill 6MWT to palliate exercise-induced dyspnoea in severe COPD. The fan was added to nasal cannulae with the flow of oxygen required to maintain saturation above 90% and tested against oxygen by nasal cannulae alone. Testing was performed during two trials a day for three days at baseline and every two minutes and breathlessness measured on a VAS and modified Borg scale.

Galbraith 2007 conducted a cross-over RCT where a handheld fan was directed to the cheek of the breathless participants and after a washout period to the leg. VAS for breathlessness was measured before and after each intervention. There was also ten minutes wash-out period between the intervention and the control.

Multi-component interventions

Interventions in this group were more difficult to categorise as many of the interventions included more than one component, provided by various professions and in different settings. Therefore categories were grouped according to the main component of the intervention as shown in additional Table 2.

1. Counselling and support

Six studies offered mainly counselling and support provided by different professions and in different settings.

Moore 2002 examined the effects of a reconfigured nurse led follow-up study in lung cancer participants. The nurse led follow-up service consisted of clinical assessment, access to the nursing clinics and communication with the general practitioner (GP) and primary care team. Participants randomized to the intervention were allocated to one of two clinical nurse specialists and were assessed monthly by protocol over the telephone or in a nurse led clinic to identify signs of disease progression, symptoms warranting intervention or serious complications. The nurse specialists provided information and support and coordinated input from other services. Breathlessness was measured on the European Organization for Research and Treatment of Cancer (EORTC) core questionnaire-lung cancer module for quality of life at three, six and 12 months.

Home visits by a community nurse were tested by Hermiz 2002. The first visit within a week of a participant's discharge from hospital included a detailed assessment of the participant's health status and respiratory function. The nurse provided verbal and written education on their disease, management of activities of daily living, exercise, use of drugs, health maintenance, and early recognition of signs that require medical intervention. The nurses identified problem areas and, if indicated, referred participants to other services. After the visit a care plan was sent to each participant's GP, and telephone contact with the general practitioner was made. At the second home visit, one month later, the participants' progress and the need for further follow-up was reviewed. Breathlessness was measured on the SGRQ at baseline and after three months.

The impact of a specialist nurse undertaking regular home visits post-rehabilitation compared to home visits by a general nurse was tested by Ketelaars 1998 in a controlled study. Specialist nurses in the study received in-service training in the area of respiratory diseases and treatment. The SGRQ was used for measurement of breathlessness pre-test on admission and at discharge from the pulmonary rehabilitation programme and at post-test, four and nine months after discharge.

A chronic disease management programme was tested by Rea 2004. The intervention group received care through their GP and a practice nurse, who were supported by a respiratory physician and a respiratory nurse specialist (action and care plan, instruction in inhaler technique and stopping smoking, review of medication, advice on flu vaccination and pulmonary rehabilitation). Participants visited the practice nurse monthly and three-monthly the GP. At least one home visit was made by the respiratory nurse specialist and one following hospital admission. Breathlessness was

measured on the CRQ at baseline and after 12 months.
Goodyer tested an intensive medication counselling programme over three months given by a pharmacist to older participants with CHF (Goodyer 1995). The intervention and the control group received three domiciliary visits at two to four weekly intervals and had a final outpatient appointment where clinical and other assessments were repeated. The intervention group received counselling on the correct use of their medications using a standard written protocol employing verbal counselling, medications calendars and information leaflets. The VAS was used to measure breathlessness at the beginning and at the end of the study (approximately ten weeks later).
McMillan 2007 tested the COPE-intervention addressing specific needs of family carers and its impact on the participants' symptoms. The following components were covered: creativity (developing new strategies of caregiving problems), optimism (developing a positive but realistic attitude), planning (setting goals for caregivers), and expert information for non-professionals (information about symptoms, symptom assessment, getting professional help). Caregivers of participants in a hospice home care programme received training by specially trained nurses over nine days. Breathlessness was assessed on the Dyspnea Intensity Scale at baseline, on day 16 and 30 of hospice admission.

2. Counselling and support with breathing-relaxation training

Two studies tested the combination of nurse-led counselling and support in combination with breathing and relaxation training to reduce breathlessness. In a feasibility study Corner 1996 tested an intervention strategy for lung cancer participants including counselling, breathing re-training, relaxation and teaching coping and adaptive strategies. The intervention group attended weekly sessions with a nurse practitioner over three to six weeks. Randomization was stopped after 31 participants as medical and nursing staff felt that participants in the intervention group had a clear benefit from the intervention strategy.
Bredin 1999 tested Corner's intervention in a multi-centre study. Lung cancer participants were either randomised to a nursing clinic with regular support, to training in breathing control techniques and relaxation or to best supportive care defined as pharmacological and palliative treatments. Participants in the intervention group attended the nursing clinic once a week for three to eight weeks. Both studies measured breathlessness on a VAS.

3. Breathing training

Hochstetter 2005 tested a 45-minute training session on physiotherapy breathlessness management including pursed lip and diaphragmatic breathing, 'blow-as-you-go', positioning and pacing techniques. The effect of the session was tested measuring breathlessness on a Borg scale after ascending and descending a flight of stairs (12 steps) at day one and three.
Wu 2006 tested the effects of breathing training on quality of life (including breathlessness) and activities of daily living. Participants in the intervention group received two weeks breathing training three times a day for 15 minutes (panic management, pursed-lip breathing, diaphragmatic breathing). Participants were asked to practice at home for the next three months (Wu 2006). A VAS as part of a quality of life scale was used for the measurement of breathlessness.
Pursed-lip breathing was also tested in Garrods study where participants were asked to perform a shuttle walking test either with pursed lip breathing or with normal breathing. Assessments were taken on a modified Borg scale before and immediately after the walk as well as noting the time to recover to pre-exercise breathlessness (Garrod 2005).

4. Case management

In Egan's study a nursing-based case management was tested for COPD participants in hospital (Egan 2002). Participants in hospital received a comprehensive nursing assessment by a case manager who also coordinated their care during hospitalization, conducted a case conference as part of the discharge planning and provided follow-up care at one week and six weeks post-discharge. The control group received usual care. The SGRQ was used to assess breathlessness at baseline, one and three months after discharge.
The second study in this group tested a multifaceted, outpatient, palliative medicine consultation intervention compared to usual primary care (Rabow 2004). Participants with cancer, advanced COPD or advanced CHF attending a general medical practice were included. A Comprehensive Care Team comprising a social worker, nurse, chaplain, pharmacist, psychologist, art therapist, volunteer coordinator and three physicians assessed physical, emotional and spiritual issues. The programme integrated primary care physicians' consultation, case management, volunteer and group support, chaplaincy consultation and artistic expression. Breathlessness was measured on the UCSD-SOB at baseline, after six and 12 months.

5. Psychotherapy

Two studies assessed the effects of psychotherapy on breathlessness. In Rosser's study COPD participants were randomly allocated for eight weeks to one of three types of psychotherapy (analytic group, supportive group, nurse group) or to an untreated control group who attended weekly laboratory tests (Rosser 1983). Follow-up was six months later. The VAS and the Fletcher scale (Fletcher 1959) were used for measuring breathlessness before and after eight weeks of observation and therapy. Eiser 1997 examined the effect of group psychotherapy on breathlessness, anxiety,

exercise tolerance and quality of life in a controlled study. The psychotherapy contained six 90 minute sessions of cognitive and behavioural psychotherapy at weekly intervals (Eiser 1997). The control group attended weekly for lung function and 6MWT for six weeks. Measures were taken on the first day, one and 12 weeks post-intervention. The VAS, Medical Research Council (MRC) dyspnoea scale and SGRQ were used as measurement tools.

Risk of bias in included studies

All included studies but two (Eiser 1997; Ketelaars 1998) were RCTs, 17 of them were cross-over trials.

Single-component interventions

1. Acupuncture/Acupressure

The Oxford Quality Scale score in this category varied from one (Wu 2004) to three (Lewith 2004; Maa 1997; Vickers 2005). According to the Edward's score one study was of medium quality (Jobst 1986) and the other studies were of high quality. The evidence grade was IA for three studies (Lewith 2004; Vickers 2005; Wu 2004) and IB for two (Jobst 1986; Maa 1997).

2. Distractive auditory stimuli (music)

Studies in this group only rated one or two on the Oxford Quality Scale. Two studies (Bauldoff 2000; Sidani 2004) were of low quality and four of high quality on the Edward's score. Two studies were scored IA (Bauldoff 2002; Bauldoff 2005), three IB (Brooks 2003; Pfister 1998; Sidani 2004) and one IC (Bauldoff 2000).

3. Relaxation

Louie's study scored three on the Oxford Quality scale (Louie 2004), the other three studies scored two (Gift 1992; Renfroe 1988; Yu 2007). On the Edward's score two studies were of high quality (Yu 2007; Louie 2004) and one of medium (Renfroe 1988) and one of low quality (Gift 1992). For the level of evidence one study was graded IA (Yu 2007), the others IB.

4. Walking Aids

Dalton and Honeyman's studies (Dalton 1995; Honeyman 1996) scored one on the Oxford Quality Scale, the other five studies in this group scored two. Dalton' study was of low quality according to the Edward's score, the other studies in this category were of high quality. Two studies were graded IA (Gupta 2006b; Solway 2002), the other studies IB.

5. Chest wall vibration

Four studies were rated with one on the Oxford Quality scale, only Lange' study scored three (Lange 2006). Using the Edward's score all studies in this category were of high quality. The evidence of all studies in this group was graded IB.

6. Neuromuscular electrical stimulation

One study was graded with three on the Oxford Quality scale (Bourjeily-Habr 2002), the other two scored one. According to the Edward' score all were of high quality. Bourjeily-Habr's study was graded IA, the other two IB.

7. Fan

Baltzan's study scored one (Baltzan 2000) and Booth's study two (Galbraith 2007) on the Oxford Quality scale. The evidence grade was IC for the Baltzan and IA for the Booth 1996 study. Booth's study was of high and Baltzan's study of medium quality on the Edwards's score.

Multi-component interventions

1. Counselling and support

In this group one study scored one on the Oxford Quality scale (Ketelaars 1998), one three (Rea 2004) and the other four studies scored two. According the Edward's score four studies (Hermiz 2002; Moore 2002; Rea 2004; McMillan 2007) were of high quality, one of medium (Goodyer 1995) and one of low quality (Ketelaars 1998). Three studies were graded IA (Hermiz 2002; Moore 2002; Rea 2004), two IB (Goodyer 1995; McMillan 2007) and one IIB (Ketelaars 1998).

2. Counselling and support with breathing-relaxation training

Both studies scored two on the Oxford Quality scale (Bredin 1999; Corner 1996). Bredin's study was of high quality on the Edward's score, Corner's study of medium quality. Corner's study was graded IB (Corner 1996), Bredin's study IA (Bredin 1999).

3. Breathing training

Two studies (Garrod 2005; Hochstetter 2005) rated three on the Oxford Quality scale and one study one (Wu 2006). All studies were of high quality on the Edward's score. Hochstetter's and Garrod's study were graded IA, Wu's study IB.

4. Case management

Rabow' study scored two (Rabow 2004) and Egan's study (Egan 2002) scored three on the Oxford Quality scale. Both studies were of high quality on the Edward's score. Rabow's study was graded IA, Egan's study IB.

5. Psychotherapy

Eiser's study (Eiser 1997) rated zero on the Oxford Quality score (Jadad 1996) and Rosser's study two (Rosser 1983). Rosser's study was of high quality and Eiser's study of medium quality on the Edward's score. The evidence grade of Rosser's study was IB and Eiser's study IIB.

The range of scores on the Oxford Quality scale of all included studies varied between zero (Eiser 1997) and three, most studies scored one or two. Low scores can be explained by the fact that blinding of the participants or the provider was not possible in most interventions described. The methodological quality graded on the Edwards' scale showed that five studies were of low and six of medium quality. All other studies could be classified as being of high quality.

Effects of interventions

Many studies used functional tests and other measures besides breathlessness. As the focus of this review is breathlessness we concentrated on reporting results on breathlessness. Functional results were only reported if they added information on breathlessness to the review. Otherwise these results are not reported as they are not relevant for this review.

Single-component interventions

1. Acupuncture/Acupressure

In Jobst's study 26 participants were included and 12 pairs, who were matched for age, sex, severity of dyspnoea and $FEV_{1,}$ were analysed (one participant was withdrawn due to change of medication and in consequence the matched participant). The traditional acupuncture group showed significantly greater benefit in subjective breathlessness scores compared to the placebo group (Jobst 1986).

Lewith 2004 included 36 participants (33 with COPD) of whom 24 completed the study. The primary outcome (worse breathlessness) improved significantly during the course of the study but there were no significant differences between acupuncture and placebo.

In Vicker's study 47 participants were randomized and 45 provided follow-up data (Vickers 2005). Participants in the acupuncture/acupressure and control group improved but there were no differences between the groups.

Thirty-one COPD participants completed Maa's study (Maa 1997). After adjusting for covariables the difference of the VAS breathlessness scores after real and sham acupressure was statistically significant. The real acupressure group had a 14.6% improvement.

Wu 2004 included 44 COPD participants. The dyspnoea scores improved significantly in the acupressure group compared to the control group.

One hundred and nine participants were included in the acupuncture and 75 in the acupressure studies. All but one study (Vickers 2005) were conducted in participants with COPD (one study had 92% COPD participants and 8% with other non-malignant pulmonary disease; Lewith 2004). Only Vickers's study was conducted in cancer participants (Vickers 2005). Meta-analysis was not possible in this category due to a variation in the interventions, different modes of reporting data and different timing of measurement. Four studies were of high quality, of which two showed significant improvement in breathlessness. Overall we graded the level of evidence as low.

2. Distractive auditory stimuli (music)

In Bauldoff's feasibility study six COPD participants were included and randomized either to exercise using DAS (distractive auditory stimuli) or no music (Bauldoff 2000). There were significant group differences in the UCSD Shortness of Breath Score for dyspnoea. In a second study DAS was provided to participants with moderate to severe COPD whilst walking (Bauldoff 2002). The intervention group (n = 12) improved on functional performance and decreased in perception of dyspnoea whereas control participants (n = 12) could not maintain what they had gained from pulmonary rehabilitation. In the third study 30 COPD participants were included and randomized either to slow DAS, moderate DAS or control (each group had ten participants) (Bauldoff 2005). There were no significant differences between the two DAS groups or the DAS groups and the control group regarding perceived dyspnoea.

Thirty COPD participants recruited from three rehabilitation programmes completed Brooks 2003 study. In both groups the dyspnoea levels increased over time during the ten minute walk whereas the anxiety levels did not change significantly. There were no differences in dyspnoea or anxiety levels between the walks with music and without music.

Pfister's study was completed by 19 COPD participants (Pfister 1998). Within each group ratings of perceived exertion and dyspnoea increased from minute one to minute six. However, there were no statistically significant differences between treatment and control groups for the distance walked, perceived dyspnoea or the rating between perceived exertion. Sixty percent of participants commented voluntarily that they enjoyed listening to music during exercise.

Twenty-six COPD participants participated in Sidani's study

(Sidani 2004). Resting for 20 minutes and resting with music were effective in reducing exercise-induced dyspnoea. There was no statistically significant difference between the two groups in dyspnoea.

All studies in this category where conducted in COPD patients. We did not perform meta-analysis in this category as three studies were standard RCTs and three were cross-over trials. Four studies were of high quality. Three of them did not show an improvement of breathlessness when using DAS during exercise. Therefore there is currently no evidence to support the use of DAS to relieve dyspnoea.

3. Relaxation

In Gift's study 26 COPD participants were included. Breathlessness scores showed no main difference between the two groups, but significant differences from pre- and post-measurement (Gift 1992). The relaxation group decreased to a greater extent in breathlessness ratings compared to the control group. In Renfroe's study progressive muscle relaxation lead to a greater reduction of breathlessness in the treatment group (7/14 COPD participants) compared to the control group during each session (Renfroe 1988). However, there was no significantly greater reduction in breathlessness from the beginning of the first session to the end of the fourth session. The treatment group showed a small reduction whereas breathlessness in the control group increased. Yu 2007 tested PMR training in 158 participants with CHF of which 121 participants completed data collection. A medium effect was seen on psychological distress and a non-significant trend towards a greater improvement in symptom status (breathlessness and fatigue) (Yu 2007). Guided imagery did not show a statistically significant difference in perceived dyspnoea between the intervention and control group in 26 COPD participants (Louie 2004).

In this category all studies but one (Yu 2007) have been conducted in COPD participants. Only Yu 2007 tested relaxation techniques in participants with CHF. As the studies in this group are too heterogeneous regarding timing of measurement and data provided we decided to abandon meta-analysis. As there were only two high quality studies in this group, we chose not to judge the strength of evidence in this group.

4. Walking aids

Dalton 1995 tested ten COPD participants. When using the wheeled walker participants had significantly less breathlessness compared to an unaided walk. There was no significant difference in breathlessness using a walking stick.

In Honeyman's study 11 subjects with chronic airflow obstruction were included (Honeyman 1996). The use of a wheeled walker resulted in a significant increase in the six-minute walking distance and a significant reduction in breathlessness during the walk test. Probst's study included 14 participants with stable COPD (Probst 2004). Breathlessness measured on a Borg scale tended to be lower with a rollator whereas the median 6MWT distance increased significantly in the rollator group. In a further study in this category 40 participants with stable COPD were included. Breathlessness was significantly lower in participants who used a rollator. Duration of rest was reduced in the group overall and in particular in those participants who walked < 300 m unaided who's distance walked also increased (Solway 2002). Gupta 2006a analysed 31/35 participants and showed that the significant reduction in dyspnoea and the improvement in the distance walked using a rollator during a 6MWT compared to an unaided walk were consistent in 31 COPD participants when re-testing after four and eight weeks (Gupta 2006a). In Gupta's second study breathlessness measured by the CRQ showed no significant difference between the assisted and unassisted walk in 31 COPD participants over eight weeks (Gupta 2006b). However, there was a significant difference in the dyspnoea domain of the CRQ in the group of participants who used the rollator regularly compared to those who only used it infrequently. Sixty COPD participants transporting their oxygen canister on a small wheeled cart had significantly less breathlessness and leg effort fatigue compared to carrying the canister on the participants shoulder (Crisafulli 2007). In the group of participants who walked less than 300 m the distance walked was also significantly increased.

All studies in this category have been conducted in COPD participants. As all studies but one in this category were cross-over trials we intended to conduct meta-analysis using the generic inverse variance function in RevMan. To calculate a standard error of the mean difference the calculation of a correlation coefficient would be necessary. To calculate this coefficient the standard deviation of the mean difference is necessary. However, the standard deviation of the mean difference was not reported in any of these studies. Therefore we abandoned the meta-analysis.

In this group six studies were assessed as having high quality. Four showed a significant improvement of breathlessness, one a non-significant improvement of dyspnoea. As the latter study was not fully powered we graded the strength of evidence as moderate.

5. Chest wall vibration

In Lange's study of 46 MND participants of whom 22 were randomized to receive HFCWO and 24 to receive the control (Lange 2006). Nineteen of the HFCWO and 16 of the untreated group completed the study. HFCWO users had significantly less breathlessness and coughed more at night at 12 weeks compared to baseline.

Fifteen participants with severe chronic respiratory disease and breathlessness at rest were investigated by Sibuya 1994. In-phase CWV decreased and out-of-phase CWV increased dyspnoea at rest. Christiano examined nine participants with emphysema and one with bronchiectasis (Cristiano 1997). In-phase CWV significantly reduced breathing discomfort measured on a VAS associated

with steady-state hypercapnia but not with exercise. Nine COPD participants were included in Nakayama's study. In-phase CWV decreased dyspnoea significantly during lifting weights straight above the head, but did not affect arm fatigue (Nakayama 1998). Fujie 2002 tested CWV in 17 COPD participants. Measured on a Borg scale CWV significantly reduced the sensation of breathlessness during exercise compared with exercise with no vibration (Fujie 2002).

One study in this category examined MND participants (Lange 2006). The other four studies included COPD participants with one study also including participants with old TB (Sibuya 1994). In Lange's study 79% of participants were satisfied with HFCWO (Lange 2006). As four studies in this category were cross-over trials with similar timings of measurement we planned to conduct meta-analyses. However, similar to the walking aids category the reporting of necessary data was insufficient and therefore meta-analysis was discarded.

All five studies in this group were of high quality. Four studies showed a significant improvement of breathlessness, one a non-significant improvement. Overall the strength of evidence was classified as high in this group. The strength of evidence remains high in the subgroup of COPD participants as Lange's study was conducted in MND participants (Lange 2006). No conclusion was possible for MND participants alone as there is only one study in this participant group.

6. Neuromuscular electrical stimulation

In Neder's study nine of 15 participants with advanced COPD received NMES at once, the other six participants after a control period of six weeks (Neder 2002). The first group had beneficial changes in the 'dyspnoea domain' of the CRQ and the second group improved significantly in this domain compared to baseline. Bourjeily-Habr 2002 included 18 participants with COPD in their study on TENS. They reached a modest but significant improvement on the Borg scale of perceived exertion at a given level of exercise and a significant increase in the shuttle walking distance. Seventeen COPD participants were tested in Vivodtzev's study (Vivodtzev 2006). Four weeks of electrostimulation improved quadriceps muscle strength and significantly decreased dyspnoea whilst performing daily tasks. There was also a significant increase in walking distance and Body Mass Index (BMI) in the intervention group.

All studies in this category included COPD participants. Two studies (Bourjeily-Habr 2002; Neder 2002) reported good tolerance of the intervention by the participants without painful or uncomfortable sensations (Neder 2002) or only mild self-limited muscle cramps (Bourjeily-Habr 2002). Due to insufficient reporting of data, meta-analysis was not possible in this category. However, the strength of evidence was high in this group as all three studies were of high quality and showed significant improvement of breathlessness.

7. Fan

Baltzan 2000 tested the fan in 17 participants with severe COPD. A small but not significant reduction of breathlessness was seen on the first day but not during the subsequent two days. The second study in this category showed a significant reduction of breathlessness when participants used a handheld fan (Galbraith 2007). This cross-over tested 49 participants with mixed cardiopulmonary disease and was adequately powered.

Meta-analysis was not possible in this category as one study was a cross-over trial (Galbraith 2007). As there were only two studies in this group we did not judge the evidence.

Multi-component interventions

1. Counselling and support

In Moore's study 271 participants were approached and 203 included in the study (Moore 2002). Three months after the beginning of the study nurse led follow-up participants rated their dyspnoea significantly less severe than participants in the conventional medical follow-up. There was no difference in breathlessness after six months but again there was a significant difference after 12 months. At that time participants in the intervention group had better scores for emotional functioning and less peripheral neuropathy. Satisfaction of participants and carers was significantly higher in the intervention group.

Hermiz 2002 included 177 COPD participants of which 147 completed the follow-up. Breathlessness was measured within the symptom subscale of the SGRQ. The overall SGRQ score showed no significant differences between the two groups in their scores at follow-up. There was no improvement in the symptom score in the intervention group, but a worsening of the symptom score in the control group.

Of the COPD participants 78/115 completed data collection in Ketelaar's study (Ketelaars 1998). Breathlessness was measured within the symptom subscale of the SGRQ. Post-rehabilitation specialised respiratory nursing care did not demonstrate superior results regarding HRQL (Health Related Quality of Life; SGRQ including symptom subscale). HRQL improved between admission and discharge in both groups but deteriorated four and nine months after discharge. Participants in the experimental group were more satisfied than the participants in the control group but only the aspects "satisfaction with the knowledge" and "information and advice received" were statistically significant.

Rea 2004 included 135 participants with moderate to severe COPD from 51 GP practices which were cluster randomized. One hundred and seventeen participants completed the 12-months follow-up. There was no improvement in dyspnoea, but a significantly greater improvement in mastery and fatigue in the intervention group.

Goodyer 1995 recruited 100 participants with CHF, 80 took part in the study. Adherence and medication knowledge improved in

the counselled group as did breathlessness and 6MWT. The scores in the control group deteriorated regarding 6MWT and breathlessness scores.
The COPE intervention for family caregivers tested by McMillan 2007 did not make a statistically significant difference in patient's dyspnoea scores but it did in general symptom distress.
The types of intervention in this category were judged to be too heterogeneous to conduct meta-analysis. As the type of counselling and support varied within the group we did not intend to grade the evidence. Creating subgroups within the category such as nurse-led counselling did not allow us to grade the strength of evidence as subgroups were too small.

2. Counselling and support with breathing-relaxation training

In Corner's study 34 participants with lung cancer were included of which 19 were randomized to the intervention and 15 to the control group (Corner 1996). Fourteen participants withdrew because of deterioration, 20 were included in the analysis. Breathlessness at rest, at worst and distress caused by breathlessness were reduced over time in the intervention but not in the control group. The intervention group showed a median improvement in breathlessness at worst of 35%, in distress caused by breathlessness of 53%, in functional capacity of 17% and a median reduction in difficulty in performing activities of daily living of 21%. The control group remained static or worsened over the same time period.
One hundred and nineteen participants were recruited for Bredin's study of which 103 were included in the analysis (Bredin 1999). Forty-four participants died or withdrew after randomization. After eight weeks the intervention group showed significant improvement for breathlessness at best WHO performance status, depression, and physical symptom distress. Levels of anxiety and distress due to breathlessness improved slightly.
The participants in this study all suffered from lung cancer. Meta-analysis in this group was not possible as the authors of both studies reported non-parametric data. As there were only two studies in this group we did not judge the strength of evidence.

3. Breathing training

Hochstetter 2005 included 30 participants with cardiopulmonary disease in their study. Participants in the intervention group had significantly less breathlessness at the top of the stairs between days one and three and at the bottom of the stairs after the descent. They also reported a significant difference between the groups at the top of the stairs on day three and at the base of the stairs after the descent. Thirty COPD participants were included in Wu's study, 20 in the intervention and ten in the control group (Wu 2006). After three months of breathing training, participants breathlessness and respiratory rate improved significantly in the intervention group. Garrod 2005 included 69 COPD participants of whom 15 were classified as natural pursed-lip breathers and were excluded from the study along with another six participants for other reasons (five participants were unable to perform pursed lip breathing, one participant's FEV_1/FVC was > 75%, indicating that he had no COPD). There was no difference in dyspnoea between walks, however, time taken to recover to pre-exercise breathlessness was significantly reduced when using pursed lip breathing during recovery.
As the interventions in this category were quite different we did not intend to conduct meta-analysis. All three studies were of high quality. Two showed a significant difference in the intervention group, therefore the strength of evidence was classified as moderate.

4. Case management

Egan 2002 recruited 66 hospitalized COPD participants. Both the intervention and the control group reported an improvement in symptoms between admission and one month post-discharge measured on the symptom subscale of the SGRQ. However, this improvement was considered predictable in view of the treatment provided during hospitalization and could not be sustained between one and three months post discharge.
Rabow 2004 included 90 participants with cancer, COPD and CHF, of which 50 received the care of the Comprehensive Care Team and 40 received usual primary care. The odds of a participant reporting any dyspnoea after 12 months were significantly fewer in the intervention group and intervention participants reported significantly less dyspnoea interfering with daily activities.
As the two interventions in this category were quite different we did not intend to conduct meta-analysis. As there were only two studies in this group we did not judge the strength of evidence.

5. Psychotherapy

Sixty-five COPD participants took part in Rosser's study (Rosser 1983). Participants in the nurse group had sustained relief of breathlessness after eight weeks and six-months follow-up but underwent less psychodynamic change. Psychiatric symptoms were reduced in the supportive but not analytical psychotherapy. The whole group experienced a significant improvement in breathlessness at the end of the group sessions but not at six-months follow-up. Eiser 1997 included ten stable COPD participants and eight controls. After psychotherapy the physiological and psychological parameters changed only in the 6MWT group when all other parameters remained constant.
As the Rosser 1983 study reported non-parametric data we did not consider meta-analysis appropriate in this category. As there were only two studies in this group we did not judge the strength of evidence.

DISCUSSION

A variety of non-pharmacological interventions exist mainly for patients with COPD to relieve their breathlessness, these interventions include those such as pulmonary rehabilitation or self-management education and they have been reviewed recently (Effing 2007; Lacasse 2006) or are currently under review (Cranston 2004). This systematic review aimed to evaluate non-pharmacological interventions to relieve breathlessness, other than pulmonary rehabilitation, self-management education, exercise, or oxygen in advanced disease. We identified 47 studies which tested a wide variety of interventions, predominantly in COPD participants.

Categorisation of interventions

The studies included in this review were heterogeneous regarding type of intervention, outcome measures, conditions and study quality. The most consistent way to divide the studies was by type of intervention rather than condition of participants or profession of health care professionals. First we differentiated between single and multi-component interventions. We classified acupuncture/acupressure, music, relaxation, walking aids, chest wall vibration, neuromuscular electrical stimulation and fan as single-component interventions. Under multi-component interventions we categorised counselling and support, counselling and support with breathing-relaxation training, breathing training, case management and psychotherapy. There were some discussions on how to categorise the counselling and support studies and those offering counselling and support in combination with breathing training and relaxation. We felt that breathing training and relaxation techniques are different to only counselling, information giving and referral as they offer an active component to the participant. Therefore we grouped them in an extra category.

We divided the interventions in these two main categories first for simplicity but also following the MRC framework for complex interventions which are defined as "a number of separate elements which seem essential to the proper functioning of the intervention although the "active ingredient" of the intervention that is effective is difficult to specify" (MRC 2000). The allocation of the interventions to either group has some limitations as there is some overlap between the two, e.g. relaxation is part of counselling and support with relaxation-breathing training. Similarly there is an overlap within the subgroups of the multi-component group, e.g. counselling and support with and without relaxation-breathing training. Multi-component interventions evaluate a number of single components although the single interventions in this review, besides relaxation, have not been part of the multi-component interventions. Nevertheless the differentiation between single and multi-component interventions can be helpful as interventions with multiple components are much more complex to evaluate and the Medical Research Council in the UK has recommended specific steps for it (MRC 2000). Besides, it gives recognition to the composite effect of the intervention.

The number of studies in each group was limited and even within the groups the interventions, the populations and the outcome measures were heterogeneous. The variety of interventions is also reflected in the various professionals that collaborate to provide them, mainly nurses but also physiotherapists, pharmacists, psychoanalysts or doctors as part of a multidisciplinary team.

Population

This review aimed to cover conditions with a high prevalence of breathlessness. However, the majority of studies throughout all categories (35/47) have been conducted in COPD participants. Only three studies examined participants with CHF (Goodyer 1995; Rabow 2004; Yu 2007) and one study participants with MND (Lange 2006). Despite the fact that breathlessness is highly prevalent in various types of cancer only three studies included participants with other types than lung cancer (McMillan 2007; Rabow 2004; Vickers 2005). RCTs in mixed populations with breathlessness seem to be rare as we only found four studies (Galbraith 2007; Hochstetter 2005; Lewith 2004; Rabow 2004). This may reflect researchers specialties and expertise in particular conditions, while a focus on a symptom may be typical for professionals who are working with advanced illness and have adopted the holistic palliative care approach.

As breathlessness is highly prevalent in COPD (Skilbeck 1998; Solano 2006) many studies included participants with a confirmed diagnosis of the disease taking disease stage and/or lung function parameters (FEV_1 etc.) as surrogate parameters for breathlessness. More advanced stages of COPD (III and IV) are defined by lower lung function parameters and greater shortness of breath (GOLD 2007). Only in recent years has it become more common to mention breathlessness and to measure it.

Most studies included participants with breathlessness on exertion, only a few studies were conducted with participants suffering from breathlessness at rest. This reflects the difficulty to conduct such studies in participants with far advanced disease as the prognosis, e.g. for participants with cancer and dyspnoea is very limited (Booth 1996).

Measures

A variety of scales were used for assessing the effects of the interventions on breathlessness. All but ten studies used uni-dimensional scales such as a modified Borg scale, VAS or NRS. Many of them combined uni- and multidimensional breathlessness measures to capture other dimensions of breathlessness such as mastery (feeling of control over the disease) or impact on daily living. Besides the effect on breathlessness, a variety of other measures

have been undertaken in the studies. Many studies conducted in COPD participants also measured the effect of the intervention on pulmonary function or used exercise measures such as walking tests. As exertional breathlessness is more often a problem in COPD, breathlessness was induced in many studies by exercise such as walking tests, e.g. in the categories distractive auditory stimuli (music) or walking aids.

This review was undertaken from a palliative care perspective. Many studies identified have been undertaken by respiratory physicians who are mainly interested in changes in lung function and other physiological parameters. In consequence 34/47 studies used lung function or exercise tests as outcome measures and many studies measured breathlessness only as a secondary outcome. It is still unclear which physiological tests correlate best with breathlessness and many of them are of limited use as breathlessness is a multi-dimensional symptom.

Analysis

We abandoned our initial intention to perform meta-analysis as aggregation of data did not seem feasible due to the variation of the interventions between and within categories, the variability of the reported data and the provision of unreported data. Despite contacting several authors only some unreported data could be received. It has been acknowledged that even in reviews focusing on effectiveness, meta-analysis is often an inappropriate approach to synthesis (Popay 2006) and that there are situations where it is misleading to perform meta-analysis when the data does not allow it (Naylor 1995). Where the experimental or quasi-experimental studies included in a review are not sufficiently similar to allow for meta-analysis, descriptive synthesis (CRD 2001) or narrative synthesis can be alternative approaches (Mays 2005; Popay 2006). We extracted the data first in to data extraction forms but later also onto standardized tables to contrast types of intervention, types of control, population, measures, timing of measurement, main outcomes and study limitations and to compare relevant findings and features. Through the tabulation of studies we were able to group them and identify similar treatments across disease groups. We see this descriptive synthesis as an important stage to highlight the existing interventions as well as the gaps in the evidence base for non-pharmacological interventions in advanced disease.

Quality of studies

The scores used for evaluating the quality of studies generated very different results. According to the Edwards score 77% of the studies scored high whereas only 21% of studies got a high ranking on the Oxford Quality Scale. As pointed out in the methods section the Oxford Quality Scale emphasizes double blinding with 2/5 points given for mentioning double blinding and appropriate description. For most interventions reviewed here double blinding was impossible. This explains the low number of high quality studies using the Oxford Quality Scale. Therefore we concentrated on the Edwards score when grading the strength of evidence.

Interventions

The evidence for the various categories varies widely. We discuss interventions with higher strength of evidence first.

Neuromuscular electrical stimulation

The studies in this category support that there is a high strength of evidence that NMES over four to six weeks helps to relieve breathlessness in COPD patients. Deconditioning and peripheral muscle weakness are known to play a major role in breathlessness in COPD (Reardon 2006). Therefore exercise training is a key component of pulmonary rehabilitation programmes. However, not all participants with severe COPD are capable of exercise and exercise training (Vivodtzev 2006). To overcome this, NMES of leg muscles, mainly quadriceps muscle, seems to be an interesting alternative. All studies showed that NMES not only improved muscle strength with improved performance in daily tasks but also decreased breathlessness. The intervention was well tolerated by participants. Muscle stimulation has to be undertaken regularly over several weeks. Neder 2002 showed that this is possible in a home care setting. To prevent development of more severe breathlessness the best timing for NMES has to be defined but it can be assumed that earlier and regular treatment should be recommended. As respiratory muscle weakness is also known to be an associated factor in breathlessness in cancer patients this intervention seems to be suitable to be tested in this group.

Chest wall vibration

CWV has been tested in two conditions, COPD and MND, showing a high strength of evidence in the whole group and also in the subgroup of COPD participants. Different mechanisms are presumed for using CWV for the relief of breathlessness. High frequency chest wall oscillation used in MND patients intends to increase mucous clearance (Lange 2006). This is of clinical importance as mucous retention is a severe problem in MND patients causing them both breathlessness and distress. There was only one study in this subgroup therefore no conclusion on the strength of evidence is drawn.

The supposed mechanism for in-phase CWV in COPD patients is activation of muscle spindles in the intercostal muscles with consecutive modification of respiratory sensations (Cristiano 1997). All studies in COPD participants (Cristiano 1997; Fujie 2002; Nakayama 1998; Sibuya 1994) were conducted in a respiratory lab and none discussed the implications and practicality of this intervention for participants at home or in long-term care. In contrast to Lange 2006 who used an inflatable vest the studies (Cristiano

1997; Fujie 2002; Nakayama 1998; Sibuya 1994) in COPD participants were conducted with vibrators attached to the chest wall.

Walking *a*ids

Compared to the other categories the studies in this group are quite homogeneous. All but one study (Gupta 2006b) tested walking aids in a cross-over design. 4/7 studies (Crisafulli 2007; Gupta 2006a; Honeyman 1996; Solway 2002) showed a significant and 2/7 (Dalton 1995; Probst 2004) a not significant decrease in breathlessness when using a walking aid combined with a larger walking distance and better mobility keeping participants more independent. The studies indicate a moderate strength of evidence. The positive effect of a walking aid on breathlessness is probably due to increased maximal voluntary ventilation by bracing the arms on the walking aid and adopting a lean forward position (Probst 2004). Stabilizing the ribcage may improve accessory muscle function allowing these muscles to be engaged in respiratory activities (Probst 2004).

All studies have been conducted in COPD participants. The use of walking aids has not been tested yet in other participant groups suffering from breathlessness. As patients with CHF or cancer are often older they may be used to walking aids to improve their mobility. As the results in COPD are encouraging walking aids could also have a positive effect on breathlessness in patients suffering from other conditions. Gupta 2006b also investigated participants' attitudes towards using a walking aid. Only a few participants used the rollator at home but appreciated it for outdoor walking or shopping.

Breathing training

Physiotherapy plays an important role in the management of breathlessness and physiotherapists are often involved in pulmonary rehabilitation programmes. Breathing training is sometimes also included in nurse-led interventions for patients with breathlessness. Altered breathing patterns with shallow breathing and dynamic hyperinflation can increase patients' breathlessness. There are various techniques physiotherapists can offer to change these patterns. Two studies used a combination of techniques including pursed-lip and diaphragmatic breathing, one study in combination with positioning (Hochstetter 2005), the other one with panic management (Wu 2006). Both studies showed a positive effect on breathlessness in the intervention group. Pursed-lip breathing is a strategy often used by COPD patients. It decreases respiratory rate and increases vital capacity thus improving gas exchange. Only one study tested the effects of pursed-lip breathing but did not show a difference in breathlessness between walks but time taken to recover was reduced (Garrod 2005). The strength of evidence is moderate if all three studies are assessed together. If the combined physiotherapy programmes are judged on their own no conclusion about the strength of evidence can be drawn as there are not enough studies in the subgroup.

Acupuncture/acupressure

This group reflects a variety of studies on acupuncture and acupressure in various combinations: either acupuncture or acupressure alone or acupuncture directly followed by acupressure. Overall results were mixed with low strength of evidence. As the studies varied in the length of the intervention from seven days (Vickers 2005) to six weeks (Maa 1997) it seems that those studies offering acupuncture or acupressure in more intense regimes (three to six weeks or more sessions within three weeks) (Jobst 1986; Maa 1997; Wu 2004) had better outcomes and showed a significant improvement of breathlessness after the intervention compared to shorter application of acupuncture/acupressure (Lewith 2004; Vickers 2005) which were not as effective. However, there were not enough studies for subgroup analysis.

The rationale for using either acupuncture or acupressure is not clear as it is not discussed in the studies. It remains to be determined which intervention is better for the relief of breathlessness in advanced disease, acupuncture or acupressure, or to what extent they are interchangeable. In a study on the quality of life in chronic obstructive asthma, which did not meet the inclusion criteria for the disease group, Maa et al compared acupuncture and acupressure and found that both relieved breathlessness with relatively small and not statistically significant differences for acupuncture to be more effective (Maa 2003b). From the patient's point-of-view acupressure has several advantages as it is non-invasive, relatively easy to learn, can be self-administered at home and therefore reduces the dependence of patients on clinic visits (Maa 2003b).

All studies but one (Lewith 2004) used sham acupuncture/acupressure. However, at least for acupuncture there is a general agreement that any invasive sham acupuncture cannot be inert and that non-specific effects make placebo-controlled trials of acupuncture difficult (Birch 2006). An alternative control could be mock TENS to the same point where acupressure is applied to as it was used by Lewith (Lewith 2004).

Distractive auditory stimuli (music)

Music is known to be an effective attention-diverting strategy reducing breathlessness during exercise (De Peuter 2004). Participants are able to perform exercise at a higher intensity, for longer duration and will help people to relax (De Peuter 2004). However, there is no sufficient evidence in this review for recommending music to relieve breathlessness.

All studies looking into the effects of music on breathlessness, identified in this review, were conducted in COPD participants, none looked into another participant group. Music was always tested in connection to exercise provoking breathlessness such as walking or upper extremity training. Music was mainly offered during the exercise, only in one study was it used whilst participants rested. Three studies, of which one was a feasibility study, integrated the use of music in a four weeks training programme where participants were asked to practice several times a week (Bauldoff 2000;

Bauldoff 2002; Bauldoff 2005). The other three studies tested the effect of music directly after the intervention (Brooks 2003; Pfister 1998; Sidani 2004). Those studies which used music as part of a long-term programme seemed to have better outcomes compared to those where music was only tested once directly after the intervention. Different types of music have been offered to the participants. In most studies participants could choose their favourite music such as pop, country, big band or classical music.

Relaxation

There is a variety of relaxation techniques. This review identified two techniques which have been tested to relieve breathlessness, PMR and guided imagery. PMR is a stress management technique to reduce muscular tension that accompanies anxiety. Participants are trained to voluntarily relax certain muscles in their body in order to reduce anxiety. PMR has to be practiced on a daily basis, thus the effect is depending on participants' adherence. Studies with PMR and daily home practice seem to have a positive effect over four weeks but the long term effect is unclear as there was no positive effect in the study which measured breathlessness and other symptoms after 14 weeks (Yu 2007). There was only one study on guided imagery without any home practice which showed no difference in breathlessness after six sessions. There were not enough studies in this category to judge the strength of the evidence.

Counselling and support

This category includes studies that offered various ways of counselling or support programmes run by nurses, care teams or pharmacists in a variety of settings. It is difficult to judge the evidence due to the heterogeneity of the studies. All studies in this category included much higher numbers of participants compared to the other categories but only two studies provided a sample size calculation. Follow-up of participants in this group was longer compared to other categories lasting up to one year. The results in this category are mixed with only two interventions showing positive effects on breathlessness (Goodyer 1995; Moore 2002).

As pharmacological therapy plays an important role in the management of breathlessness Goodyer 1995 developed a counselling programme for compliance with medication provided by pharmacists which had a positive impact on participants' breathlessness.

Moore 2002 offered lung cancer participants a reconfigured nurse-led clinic with monthly assessments focusing on providing information, support and coordinating input from other services also showing a positive effect on breathlessness. This study also provided information about costs showing no significant difference between treatments.

Hermiz's and Ketelaars' interventions were provided in the participants' home with regular visits by specialist nurses who focused on assessment and management of breathlessness (Hermiz 2002; Ketelaars 1998). There is some overlap in these two studies to self-management education but we decided to include them in this review as one study (Hermiz 2002) involved a detailed health and respiratory assessment and referral to other services, and the other study (Ketelaars 1998) included discussion of relevant topics, advice and referral in the intervention. Furthermore the interventions in both studies were not embedded in a formal programme that aimed to improve the patients' knowledge and understanding of COPD as it is required in the definition of self-management (Effing 2007).

Improvement of patients' breathlessness can also be achieved by training the carers in breathlessness management. Ketelaars 1998 trained community nurses whereas McMillan 2007 trained family carers to assess breathlessness, identify potential problems and provide action plans.

A multi-professional approach for chronic disease management was used in Rea's study where general practitioners and practice nurses were supported by respiratory physicians and nurses (Rea 2004). However, all these studies failed to show a positive effect on breathlessness.

Counselling/support with breathing-relaxation training

We summarized two studies in this category which tested an intervention comprised of counselling and support in combination with relaxation and breathing training (Bredin 1999; Corner 1996). The two studies seem very similar to those in the category 'counselling and support' but we decided to treat them separately as they included an active component for participants to practice relaxation and breathing training. The development of this intervention was based on pulmonary rehabilitation programmes used in COPD patients but that were specifically tailored to the needs of lung cancer patients as there were only a few services available for this patient group. This intervention comprised some of the components which are also included in this review separately. One study was a feasibility study (Corner 1996) that was followed by an adequately powered multi-centre RCT (Bredin 1999). Both studies showed an improvement in breathlessness in the intervention group. Corner described a lasting effect of the three week intervention after 12 weeks. As there were no more studies testing such a composition of elements we can not conclude the strength of evidence.

Fan

A hand-held fan is a very simple measure intended to relieve breathlessness which is practical and economical and easy to use at home. A flow of air to the face, nasal mucosa, or pharynx may alter ventilation (Schwartzstein 1987) but the exact mechanism behind this effect is unclear. It has been used successfully in healthy participants (Schwartzstein 1987). Two studies tested this simple intervention: a small pilot study did not show sufficient improvement

but an adequately powered cross-over trial showed a significant improvement in breathlessness (Galbraith 2007). This simple device seems to be very practical for patients in everyday life independent from any provider or setting.

Case management

The two studies pooled in this category tested different types of CM with mixed results. CM was either provided by a multiprofessional comprehensive care team (Rabow 2004) or by a nurse (Egan 2002). CM was combined with psychosocial support for participants and training for caregivers (Rabow 2004) or offered coordination of hospital care (Egan 2002). The temporary effect of the latter intervention could not be sustained and was related to hospital treatment whereas the CM offered by the multiprofessional team had a positive long-term effect on breathlessness whereas in Rabow's sufficiently powered study an improvement of breathlessness could be achieved.

Psychotherapy

Both studies in this group failed to show improvement in breathlessness. Rosser 1983 aimed to show that psychotherapy is better in relieving dyspnoea in COPD participants than medical treatment on its own but instead of testing one intervention they investigated three types of psychotherapeutic management. A sample of 65 participants seems to be too small and the authors did not provide a sample size calculation. Interestingly the group treated by a nurse without psychotherapy training had better relief of dyspnoea compared to the intervention group. The authors questioned themselves whether a psychotherapeutic intervention is feasible for patients who don't seek psychological treatment. Furthermore the randomization seemed to be incomplete as the control group had higher anxiety and depression. Eiser's pilot study was controlled but not randomized and had a small sample size (Eiser 1997). Opposite to Rosser's study the treatment group was significantly more anxious than the control group. In consequence properly designed RCTs are necessary to judge the evidence of psychotherapy for the relief of breathlessness.

Limitations

When we developed our search strategy we aimed to cover as many terms as possible. However, we were not able to test the sensitivity and specificity of our search strategy and this review has shown how difficult it is to identify all relevant literature (Sladek 2006). We tried to search as much grey literature as possible such as textbooks and websites. However, we are aware that there is a huge amount of unpublished literature such as Masters and PhD theses that could have been relevant to the topic. Several studies identified have been conducted in the respiratory laboratory. As many of these studies did not have breathlessness as the primary outcome but physiological measures or exercise tests we might have missed other relevant studies.

This review adds to the picture of non-pharmacological interventions to relieve breathlessness and fills some of the gaps of existing evidence which was predominantly conducted in COPD. Our aim to determine the effectiveness of non-pharmacological interventions to relieve breathlessness in advanced disease was partially met as it was possible to find out which intervention strategies are available and to determine the effectiveness of some of these interventions. However, due to the heterogeneity of the identified studies it was not possible and would not be sensible to determine the overall effectiveness of all interventions. As most interventions were only tested in one patient group it was not possible to find out which intervention worked best for which group. This questions needs to be answered when further research has been conducted in this field.

AUTHORS' CONCLUSIONS

Implications for practice

Giving recommendations for the clinical setting is limited by the fact that most interventions were only tested in one patient group. Weighing up the findings of this review the following can be summarized:

- The studies testing neuroelectrical muscle stimulation indicate strong evidence that this intervention is helpful to relieve breathlessness in COPD patients.
- The studies evaluating chest wall vibration show that there is strong evidence that this intervention can relieve breathlessness in COPD patients. However, the practical implication of this intervention is unclear as the studies were only conducted in the respiratory laboratory.
- The studies testing the use of walking aids (rollators) indicate moderate strength of evidence that there is some benefit for COPD patients with breathlessness.
- The studies testing breathing training suggest that there is moderate strength of evidence that patients with breathlessness benefit from it.
- There is not enough evidence to recommend the routine use of acupuncture/acupressure, distractive auditory stimuli (music), relaxation, fan, counselling and support programmes, counselling and support programmes in combination with relaxation and breathing training, case management, and psychotherapy. These interventions need further testing before they can be routinely used in clinical practice.

This review showed the big gap of evidence outside COPD. Many studies have been conducted either in the respiratory laboratory

or in respiratory settings with little connection to palliative and end-of-life care. This review contributes to the need to view such interventions offered to participants with COPD or CHF from a palliative care perspective and will hopefully foster the cooperation between the different specialties to further improve the management of breathlessness in participants with advanced diseases.

Implications for research

Overall more research is needed to establish the role of non-pharmacological interventions in the management of breathlessness. Studies with sufficient sample size and power calculations are necessary in palliative care settings where many of these breathless patients are cared for. Interventions that have shown positive effects on breathlessness in COPD patients need to be tested in other conditions as the effects cannot necessarily be extrapolated, e.g. neuro-electrical muscular stimulation, chest wall vibration, walking aids and breathing training. New non-pharmacological interventions to relieve breathlessness should be tested in a variety of conditions.

Currently there is a big research gap in diseases other than COPD especially in cancer but also in CHF, MND and ILD. The effectiveness of chest wall vibration should be tested outside the respiratory lab. The best timing for neuro-electrical muscular stimulation should also be investigated. Further studies regarding the effectiveness of acupuncture or acupressure should also consider whether one or the other or a combination of both is best to relieve breathlessness in advanced disease. There is a need for the use of universal outcome measures such as unidimensional scales (e.g. the modified Borg scale or the VAS) to better compare outcomes of the studies.

Further research is needed to test the long-term effect of successful interventions as breathlessness is an ongoing problem in advanced disease until the end of life. Interventions should be developed and tested for patients with breathlessness at rest. Interventions need to be evaluated also with a mixed methods approach, applying parallel qualitative evaluations providing additional results to the effectiveness of interventions, relating to their use and acceptability to patients and carers.

ACKNOWLEDGEMENTS

We are grateful to Dr Farida Malik who helped with extraction of data of included studies and Dr Gao Wei who helped with extraction of data from a Chinese paper.

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* *Indicates the major publication for the study*

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Baltzan 2000

Methods	RCT, cross-over (abstract only) Oxford Quality Scale: 1 to 0 Grade of evidence: IB Methodological quality: 14/22
Participants	N = 17, COPD FEV1 predicted 28%, BMI mean (SD): 23.9 (5.8) kg/m² Age mean (SD): 70 years (9.9) INCLUSION CRITERIA: not mentioned EXCLUSION CRITERIA: not mentioned
Interventions	INTERVENTION: fan blowing on the face added to nasal cannulae with the flow of oxygen to maintain saturation > 90% during a controlled 6MWT; testing during 2 trials a day for 3 days CONTROL: oxygen by nasal cannulae alone
Outcomes	VAS dyspnoea at baseline and every 2 minutes: first day difference 0.4 (CI 0.12 - 0.63, P = 0.01), subsequent 2 days 0.15 (CI -0.39 - 0.78, P = 0.53)
Notes	Patients comments on interventions: half the subjects declared a preference for the fan without any association with reduction in dyspnoea AUTHORS CONCLUSION: The fan may provide a small and transient or placebo effect to reduce exercise-induced dyspnoea

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Bauldoff 2000

Methods	RCT (abstract only) Oxford Quality Scale: 1 to 0 Grade of evidence: IC Methodological quality: 6/22
Participants	N = 6, COPD INCLUSION CRITERIA: not mentioned EXCLUSION CRITERIA: not mentioned
Interventions	INTERVENTION: n = 3; DAS (walkman and audiocassette with 4 music options: pop, country, big band and classical) applied to a walking program CONTROL: n = 3, no music

Bauldoff 2000 (*Continued*)

Outcomes	Modified Borg Scale, SGRQ, UCSD Shortness of Breath Score
Notes	AUTHORS CONCLUSION: Significant between group differences in UCSD and Borg score for dyspnoea

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Bauldoff 2002

Methods	RCT Oxford Quality Scale: 1 to 0 Grade of evidence: IA Methodological quality: 20/22
Participants	N = 24, COPD Age mean (SD) 68.1 years (8) Sex: M 4 (17%)/F 20 (83%) FEV1% predicted, mean (SD): intervention group 40.42 (15.59), control group 42.25 (10.45) Modified Borg Scale, mean (SD): intervention group 2.92 (1.24), control group 3.58 (1.08) Perceived Dyspnoea (UCSD-SOB), mean (SD): intervention group 60.25 (23.23), control group 45.5 (21.28) 6 Min. Walking Distance (6MWT), mean (SD) feet: intervention group 1022.8 (233.17), control group 1128.92 (286.26) INCLUSION CRITERIA: COPD diagnosis, FEV1 < 50% predicted; 40 to 85 years; speak, read, write English; ability to hear music; completion of pulmonary rehabilitation programmes; time since completion PRP: less or 6 months prior to study entry EXCLUSION CRITERIA: unstable cardiac disease; musculoskeletal disability; inability to walk independently due to disease advancement; diagnosis of deafness
Interventions	INTERVENTION: n = 12; instruction to walk at their own pace for 20 to 45 min, 2 to 5 times a week, using distractive auditory stimuli (DAS) with a portable audiocassette player with four types of music. Data collection at baseline, 4 weeks and 8 weeks CONTROL: n = 12; same instructions for walking, but no DAS
Outcomes	Modified Borg Scale mean (SD) after 4 to 8 weeks: intervention group 3.3 (1.2) - 3.0 (1.2), control group 3.2 (1.1) - 3.2 (0.8) UCDS-SOB after 8 weeks: intervention group decrease in dyspnoea, control group increase in dyspnoea (F = 15.126, df = 2.22, P = 0.000) 6 MWT after 8 weeks, mean (SD): intervention group 1467.5 feet (363.3), control group 959.8 feet (245) Anxiety (STAI state), mean (SD) after 4 to 8 weeks: intervention group 33.2 (12.9) - 28.0 (9.1), control group 38.1 (9.8) - 34.6 (9.1)

Bauldoff 2002 (*Continued*)

Notes	AUTHORS CONCLUSION: Subjects who used DAS while walking had improved functional performance and decreased perceptions of dyspnoea

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Bauldoff 2005

Methods	RCT Oxford Quality Scale: 2 to 0 Grade of evidence: IA Methodological quality: 20/22
Participants	N = 30, COPD Age mean (SD): intervention groups (moderate/slow DAS): 57.8 (12)/67.8 (9), control group 63.3 (10) Sex: intervention groups M 4/F 6; control groups M 5/F 5 FEV1 predicted %, mean (SD): intervention groups (moderate/slow DAS): 33.8 (16.3)/41.3 (17.8), control group 46.1 (19.9) perceived dyspnoea (UCSD-SOB): intervention groups (moderate/slow DAS): 65.8 (21.8)/58.4 (22.9), control group 55.2 (22.8) 6-min Peg and Ring Board count: intervention groups (moderate/slow DAS): 144.3 (29.5)/128.7 (22.3) , control group 140.3 (20.9) INCLUSION CRITERIA: diagnosis of COPD and FEV1/FVC < 70%; prior enrollment in pulmonary rehabilitation programme, ability to read, write, speak English; willingness/ability to perform arm exercise EXCLUSION CRITERIA: unstable cardiac disease; musculoskeletal disability preventing arm exercise; cognitive impairment limiting completion of questionnaires; untreated deafness precluding use of walkman-type devices
Interventions	INTERVENTION: moderate DAS group (n = 10) and slow DAS group (n = 10) subjects were instructed to perform upper extremity training (UET) for up to 15 minutes 3 to 5 times a week using DAS (walkman, audiocassettes) CONTROL: n = 10, received the same instructions, but no DAS
Outcomes	UCDS-SOB mean (SD) after 4 weeks: moderate 62.3 (21.8), slow 53.9 (22.3), control 54.0 (16.7) 6-minute Peg and Ring Board count after 4 weeks: moderate 190.1 (24.7), slow 174.4 (23.0), control group 144.9 (21.5)
Notes	AUTHORS CONCLUSION: No significant differences in perceived dyspnoea between DAS and control group, significant differences between moderate DAS and control and slow DAS and control, no difference between moderate and slow DAS

Risk of bias

Item	Authors' judgement	Description

Bauldoff 2005 (*Continued*)

Allocation concealment?	Unclear	B - Unclear

Bourjeily-Habr 2002

Methods	RCT Oxford Quality Scale: 2-1 Grade of evidence: IA Methodological quality: 21/22
Participants	N = 18, COPD Age mean (SD): intervention group 61.5 (2.2), control group 58.5 (2.1) FEV1 pred. % intervention group 40.7 (3.9), control group BMI kg/m² mean (SD): intervention group 27.1 (1.8), control group 27.1 (1.8) INCLUSION CRITERIA: forced expiratory volume in 1 second (FEV1) <65% of predicted value with an FEV1 to forced vital capacity (FVC) ratio of < 70%, hyperinflation based on residual volume/total lung capacity (RV/TLC) ratio > 40%, and reduced lung transfer factor; age < 70 years; self-reported exercise limitation despite pharmacological treatment; were otherwise medically stable EXCLUSION CRITERIA: history of cardiovascular and neuromuscular disease, active or debilitating joint disease; formal pulmonary rehabilitation within 2 years of the date of inclusion into the study
Interventions	INTERVENTION: n = 9, transcutaneous electrical muscle stimulation with two surface patch electrodes applied to each quadriceps, hamstring and calf muscles. Electrical stimulation 20 minutes on each limb, 3 days/week for 6 continuous weeks on an outpatient basis CONTROL: n = 9, same electrode, stimulator set up, and connection system with the unit on, identical time periods in the same setting but no active electrical stimulation during the visits
Outcomes	Perceived exertion on Borg scale: intervention group baseline 12.7 (0.64), after 6 weeks 10.1 (0.9), control baseline 12.8 (0.88), after 6 weeks 12.6 (0.76) incremental SWT: intervention group pre 185.6 (21.8), post 254.4 (30.4), control group pre 247.8 (13.5), post 247.8 (14.1)
Notes	AUTHORS CONCLUSION: Modest but significant improvement in the Borg scale of perceived exertion at a given level of exercise; significant increase in shuttle walking distance

Risk of bias

Item	**Authors' judgement**	**Description**
Allocation concealment?	Unclear	B - Unclear

Bredin 1999

Methods	RCT Oxford Quality Scale: 2-0 Grade of evidence: IA Methodological quality: 20/22
Participants	N = 119, 16 excluded from analyses as centre failed to adhere to study protocol; lung cancer Disease: intervention group mesothelioma = 8, NSCLC = 32, SCLC = 11; control group mesothelioma = 6, NSCLC = 32, SCLC = 13, diagnosis not confirmed = 1 Age mean (range): intervention group 68 (41 to 82), control group 67 (41 to 83) Sex intervention group 41 M (80%)/ 10 F (20%), control group 35 M (67%)/17 F (33%) WHO performance status median (range): intervention group (n = 49) 2 (0 to 3), control group (n = 51) 1 (0 to 3) INCLUSION CRITERIA: Patients diagnosed with SCLC, NSCLC or mesothelioma who had completed treatment and reported breathlessness; shortness of breath defined as a reported change in breathing or degree of breathlessness as perceived by the patient and reported as a problem
Interventions	INTERVENTION: n = 51, intervention carried out by specialist nurse; detailed assessment of breathlessness and factors ameliorate or exacerbate; advice & support on managing breathlessness for patients and their families; exploration of meaning of SOB, their disease and feelings about the future; training in breathing control techniques, progressive muscle relaxation, and distraction exercises; goal setting to complement breathing and relaxation, to help in the management of functional and social activities, and to support the development and adoption of coping strategies; early recognition of problems warranting pharmacological or medical intervention CONTROL: n = 52, best supportive care (standard management and treatment for breathlessness) available to patient's within each centre. This included pharmacological and palliative treatments and treatment of associated problems such as anxiety and depression. All patients taking part had access to routinely available supportive care
Outcomes	Data collection: baseline, 4 and 8 week assessment; VAS distress caused by breathlessness median (range): intervention group baseline 6 (0 to 10), after 8 weeks 0 (-9 to 11), control group baseline 5 (0 to 10), after 8 weeks 10 (-7 to 11) VAS breathlessness at worst median (range): intervention group baseline 7.5 (0 to 10), after 8 weeks 1 (-7.2 to 8.5), control group baseline 7.9 (0 - 10), after 8 weeks 4.8 (-6.2 to 8.5) VAS breathlessness at best median (range): intervention group baseline 4 (0 to 9.1), after 8 weeks 1.3 (-7.1 to 8.5); control group baseline 3.5 (0 to 8.9), after 8 weeks 7 (-3.3 to 8) HADS median (range): intervention group baseline anxiety 7 (0 to 17), depression 6 (0 to 16), after 8 weeks anxiety 0 (-7 to 11), depression 0.5 (-10 to 7); control group baseline anxiety 6 (0 to 17), depression 5 (2 to 14), after 8 weeks anxiety 9.5 (-6 to 11), depression 6 (-7 to 7)
Notes	Handling of missing data with Gould method: Patients who withdrew for any reason other than they reported being too well to continue were given a change score that was one more (that is worse) than the maximum of the patients who did not withdraw Any patient who withdrew because he or she reported being too well to continue was given a score which was one less than the minimum of the score of the patients who did not withdraw AUTHORS CONCLUSION: Patients who attended nursing clinics and received the breathlessness intervention experienced improvements in breathlessness, performance status, and physical and emotional states relative to control patients
Risk of bias	

Bredin 1999 (*Continued*)

Item	Authors' judgement	Description
Allocation concealment?	Yes	A - Adequate

Brooks 2003

Methods	RCT, cross-over Oxford Quality Scale: 1 to 0 Grade of evidence: IB Methodological quality: 16/22
Participants	N = 30, COPD Age mean (SD): 70 years (7) Sex: M 15/F 15 Modified Borg scale mean (SD): 4.4 (1.5); 67% with dyspnoea every day INCLUSION CRITERIA: diagnosis of COPD; can speak and read English; can ambulate independently; reported experiencing dyspnea once a week; showed an increase in the level of perceived dyspnea after a 6 minute walk
Interventions	INTERVENTION: 6-min walk to induce dyspnoea before being tested under each condition, then 10 min. walking with listening to music (moderate tempo baroque music), same instructions as control but with music, in patients home CONTROL: 6-min walk to induce dyspnoea before being tested under each condition, then walking only (no music): participants were asked to walk for 10 minutes at their own pace. The researcher accompanied the subject in order to measure the distance walked and did not initiate conversation or encouragement. Conducted in patient's home
Outcomes	Modified Borg Scale: measurement at baseline (before 6-minute walk) and before and after the 10-minute test walks. Level of dyspnoea changed over the three points of measurement ($F(2.58) = 75.5$, $P < 0.01$). Intervention group baseline 1.4, pre-test 4.3, post-test 5.0. Control group baseline 1.1, pre-test 4.3, post-test 5.2. Post-test mean scores in intervention and control group not significantly different in dyspnoea scores ($P > 0.05$). Percentage of participants who showed either no or change or positive change (i.e. decrease) in level of dyspnoea was much lower after walking with no music (32%) than after walking while listening to music (55%)
Notes	AUTHORS CONCLUSION: No differences in dyspnoea or anxiety levels between the walks with music and with no music

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Corner 1996

Methods	RCT, pilot study Oxford Quality Scale: 2-0 Grade of evidence: IB Methodological quality: 14/22
Participants	N = 34, 20 analysed, lung cancer Age (median): intervention group 55 years, control group 69 years Sex: intervention group M 5/F 6, control group M 7/F 2 local disease: intervention group 4, control group 3 advanced disease: intervention group 7, control group 6 INCLUSION CRITERIA: Patients with small cell and non-small cell lung cancer who had completed chemotherapy or radiotherapy and were suffering from breathlessness
Interventions	INTERVENTION: n = 11; an intervention strategy based on rehabilitation techniques used in COPD including counselling, breathing re-training, relaxation and teaching coping and adaptation strategies. Patients attended weekly sessions with a nurse (approx 1 hr) over 3 to 6 weeks. Follow-up sessions were available as required. Sessions included detailed assessment of breathlessness, feelings for the future, patients were given advice and support on managing breathlessness and involving family members, breathing re-training and relaxation techniques CONTROL: n = 9; received detailed assessments of breathlessness during outcome interviews. Encouraged to talk freely about breathlessness and disease but were not offered breathing re-training or counselling
Outcomes	Change in VAS breathlessness at best 4 - 12 weeks median (range): intervention group 0.7 (-3 to 2.8) - 0.5 (-0.5 to 2.8); control group -1.5 (-5 to 1.5) Change in VAS breathlessness at worst 4 - 12 weeks median (range): intervention group 0.3 (-3 to 7.5) - 3.5 (-1 to 7) (P < 0.05); control group 0 (-3.7 to 2.5) - 0 (-5 to 4) Change in distress caused by breathlessness 4 to 12 weeks median (range): intervention group 3 (-1.5 to 9) (P < 0.01) - 5.3 (0 to 9) (P < 0.05); control group 0.5 (-2 to 5) - -1.0 (-4.5 to 3)
Notes	14 dropouts (8 intervention group, 6 control group) because of deterioration AUTHORS CONCLUSION: Lung cancer patients suffering from breathlessness benefited from this rehabilitative approach to breathlessness management

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Crisafulli 2007

Methods	RCT, cross-over Oxford Quality Scale: 1-1 Grade of evidence: IB Methodological quality: 20/22
Participants	N = 60, COPD, FEV1 65.5% INCLUSION CRITERIA: LTOT for at least 6 months before enrollment; stable condition with no

Crisafulli 2007 (*Continued*)

	evidence of acute exacerbation or change in medication in the previous 4 months; diagnosis of COPD according to GOLD criteria
Interventions	INTERVENTION: n = 60, two 6 MWT at the same time on 2 consecutive days in the first week after hospital admission in randomised test order: patient pulled full oxygen canister on the floor using a small, light, wheeled cart (aid motility) CONTROL: n = 60, carrying the same oxygen canister on the patients shoulder
Outcomes	Modified Borg Scale (peak effort dyspnoea) mean (SE) in all patients: aid 3.9 (0.3), no-aid 5.8 (0.3), < 300 m walking: aid 4.0 (0.3), no-Aid 6.0 (0.3), > 300 m walking: aid 5.5 (0.4), no-Aid 3.8 (0.5)
Notes	AUTHORS CONCLUSION: significant changes for distance, peak effort dyspnoea, leg fatigue, oxygen saturation and heart rate

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Cristiano 1997

Methods	RCT, cross-over Oxford Quality Scale: 1 to 0 Grade of evidence: IB Methodological quality: 18/22
Participants	N = 10, 9 with emphysema, 1 with bronchiectasis Age mean (SD) 63 (9) FEV1 pred. 27% (14) EXCLUSION CRITERIA: evidence of restrictive lung disease by history or pulmonary function testing; history of heart disease; signs of active pulmonary infection
Interventions	INTERVENTION: 2 standard physiotherapy vibrators, manually triggered during inspiration, applied bilaterally over the second and third intercostal spaces in the parasternal position. breathlessness induced either through steady-state hypercapnia or exercise on lower extremity cycle ergometer CONTROL: 1. deltoid vibration (triggered during inspiration); 2. no vibration (vibrators remained in parasternal position but were not activated)
Outcomes	VAS breathlessness discomfort: steady-state hypercapnia: chest wall vibration 2.3 (1.4), deltoid vibration: 2.9 (2.1); chest wall vibration 2.6 (2.0), no vibration 3.3 (2.1); exercise: chest wall vibration 2.8 (1.5), deltoid vibration 3.0 (1.6); chest wall vibration 3.2 (1.6), no vibration 3.6 (1.7)
Notes	AUTHORS CONCLUSION: In-phase chest wall vibration significantly reduced breathing discomfort associated with steady-state hypercapnia but not with exercise

Risk of bias

Cristiano 1997 (*Continued*)

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Dalton 1995

Methods	RCT, cross-over Oxford Quality Scale: 1 to 0 Grade of evidence: IC Methodological quality: 10/22
Participants	N = 10, COPD Age mean 64.6
Interventions	INTERVENTION: n = 10, 6 MW with a walking stick (WS) or a wheeled walker (WW) in random order Control: n = 10, unaided 6 MW
Outcomes	Modified Borg Scale median (95% CI): WW 2.1 (0.7), unaided 3.7 (1.2)
Notes	AUTHORS CONCLUSION: Patients significantly less breathless when using a WW, no significant difference with WS

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Egan 2002

Methods	RCT Oxford Quality Scale: 2 to 1 Grade of evidence: IB Methodological quality: 20/22
Participants	N = 66, COPD (38 severe, 28 mild/moderate) Age: intervention group 67.2, control group 67.8 Sex: intervention group 12 M (36%), control group 20 M (60%) INCLUSION CRITERIA: aged 18 years or older; history of chronic bronchitis (with infection), emphysema, chronic airway obstruction, chronic asthma, or a combination of these; forced Expiratory Volume (FEV1) on admission prior to initializing intravenous medications to determine severity of disease; cognitive function at time of entry to the study was adequate to understand and complete a questionnaire; admission to a respiratory unit bed within 72 hours of admission to hospital, informed consent was obtained in writing

Egan 2002 (*Continued*)

Interventions	INTERVENTION: n = 33, patients in hospital: comprehensive nursing assessment by the case manager who also coordinated their care during hospitalization, conducted a case conference as part of discharge planning and provided follow-up care at 1 week and 6 weeks post-discharge CONTROL: n = 33, usual care
Outcomes	SGRQ symptom subscale: median change between baseline and 1 month postdischarge intervention group -17.5, control group -9.3 SGRQ symptom subscale: median change between 1 months and 3 months postdischarge intervention group 2.0, control group 0.5 HADS anxiety: median change baseline - 1 month postdischarge intervention group -1.0, control group -2.5, median change 1 month - 3 months postdischarge intervention group 0, control group -1.5 HAD depression: median change baseline - 1 month postdischarge intervention group 0.5, control group -1, median change 1 month - 3 months postdischarge intervention group -0.5, control group 0.5
Notes	AUTHORS CONCLUSION: The improvement in symptoms, which occurred between T1 and T2, was not sustained to T3 for either group

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Eiser 1997

Methods	controlled study Oxford Quality Scale: 0 to 0 Grade of evidence IIB Methodological quality: 13/22
Participants	N = 18, COPD Age: intervention group 73, control group 71 Sex: intervention group 4 M, 8 F, control group 4 M/4 F INCLUSION CRITERIA: severe but stable COPD; HADS anxiety scores > = 8 EXCLUSION CRITERIA: chest infection within 1 month of the start of the study
Interventions	INTERVENTION: n = 10, six 90 min. sessions (each with a psychiatrist) at weekly intervals in groups of five to six. Patients were encouraged to discuss physical symptoms, psychological and physiological effects of disease on quality of life, explored concepts of anxiety; teaching of simple deep breathing exercises and deep muscle relaxation and distraction techniques; homework: breathing and relaxation exercises for 10 min three times daily with the aid of tapes CONTROL: n = 8, patients attended the laboratory seven times at weekly intervals
Outcomes	VAS mean (SD): baseline intervention 34 (23), 1-week post-treatment 36 (24), 3 months post treatment 37 (21), control baseline 55 (27), 6 weeks 53 (32) MRC dyspnoea scale mean (SD): intervention baseline 3 (1), 1-week post treatment 3 (2), 3 months post treatment 3 (2), control baseline 3 (1), 6 weeks 3 (1)

Eiser 1997 (*Continued*)

Notes	AUTHORS CONCLUSION: no significant differences in VAS dyspnoea scores either at start of treatment or at end of it

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	D - Not used

Fujie 2002

Methods	RCT cross-over Oxford Quality Scale: 1 to 0 Grade of evidence: IB Methodological quality: 18/22
Participants	N = 17, COPD FEV1 pred. mean (SD): 39.0 (15.8) Age mean (SD): 72.2 (5.7) Sex: 100% M INCLUSION CRITERIA: COPD; stable disease EXCLUSION CRITERIA: not explicitly stated as exclusion criteria but as "patients did not have": history of heart disease; symptoms of active pulmonary infection; involvement in pulmonary rehabilitation programme
Interventions	INTERVENTION: exercise with in-phase chest wall vibration (two pairs of vibrators synchronized to respiratory phase). Vibration (100 Hz) automatically reversed according to the respiration phase. Upper vibrators triggered to run during inspiration, lower vibrators triggered to run during expiration) CONTROL: exercise without chest wall vibration
Outcomes	Borg dyspnoea score mean (SD): intervention group 12.4 (2.9), control group 13.6 (2.9)
Notes	AUTHORS CONCLUSION: Chest wall vibration significantly reduced the sensation of dyspnoea compared with no-vibration

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Galbraith 2007

Methods	RCT Oxford Quality Scale: 2 to 0 Grade of evidence: IA Methodological quality: 16/22
Participants	N = 49, 48 completed study, various conditions: COPD (n = 24), lung cancer (n = 10), asthma (n = 8) , heart disease (n = 15), bronchiectasis (n = 6), pneumonitis (n = 4), pulmonary fibrosis (n = 1), other cancer (n = 5); 19/49 had multiple underlying conditions Age mean (SD): 71.6 (range 42 to 90) INCLUSION CRITERIA: stable chronic breathlessness from any cause; dyspnoea > 2 on dyspnoea exertion scale EXCLUSION CRITERIA: oxygen dependant; anaemia; fever; unable to use VAS or fan; treatment changes in previous 48 h
Interventions	INTERVENTION: handheld fan directed to the cheeks CONTROL: handheld fan directed to leg
Outcomes	VAS breathlessness: statistically significant difference between two groups (P = 0.003)
Notes	AUTHORS CONCLUSION: A drought of air from a handheld fan directed at the cheeks significantly reduces the sensation of breathlessness in patients with advanced disease

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Garrod 2005

Methods	RCT, cross-over Oxford Quality Scale: 2 to 1 Grade of evidence: IA Methodological quality: 19/22
Participants	N = 69, 15 excluded because natural pursed lip breathing (PLB), 5 unable to perform PLB, 1 patient FEV1/FVC ratio > 75% COPD, Age mean (range): nonpursed lips breathers 69 (52 to 83), natural pursed lips breathers 66 (51 to 80) FEV1 predicted (%) mean (SD): nonpursed lips breathers 46.1 (18), natural pursed lips breathers 40.0 (16.9)
Interventions	INTERVENTION: incremental SWT with pursed lip breathing taught by physiotherapist CONTROL: incremental SWT with normal breathing
Outcomes	Modified Borg scale mean (SD): PLB walk 3.8 (1.1), non-PLB walk 4.0 (1.3) Time to recovery to pre-exercise breathlessness mean (SD): PLB walk 189.5 sec, non-PLB walk 214.5 sec. (120.6)

Notes	AUTHORS CONCLUSION: no difference in dyspnoea between walks, time taken to recover to pre-exercise breathlessness significantly reduced when used PLB during recovery

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Gift 1992

Methods	RCT Oxford Quality Scale: 2 to 0 Grade of evidence: IB Methodological quality: 12/22
Participants	N = 26, COPD FEV1 predicted 54% Age mean (SD): intervention group 72 (SD 8), control group 65 (SD 18) Sex: intervention group M 3 / F 10, control group M 5/ F 8 INCLUSION CRITERIA: COPD; not confounded with other medical diagnoses; patients having dyspnea; ability to read and understand English; willing to participate and signing a consent form
Interventions	INTERVENTION: n = 13, sitting in comfortable position, relaxation was taught using a prerecorded tape instructing them in progressive muscle relaxation techniques (tension release in 16 muscle groups) in four weekly sessions; tape was given to take home and instructed to practice at home and record practice times CONTROL: n = 13, 4 weekly visits, instruction to sit quietly for 20 min. Instruction to sit quietly and relax at home to record times of relaxation
Outcomes	Data collection: baseline and end of fourth session VAS Dyspnoea mean (SD): intervention group baseline 53 (16), post-treatment 41 (11), control group baseline 53 (22), post-treatment 20 (17) Spielberger Anxiety Inventory: intervention group baseline 45 (9), post-treatment 32 (14), control group baseline 37 (6), post-treatment 37 (6) Peak Expiratory Flow Rate: intervention group baseline 203 (65), post-treatment 193 (79), control group baseline 173 (68), post-treatment 184 (55)
Notes	Patients comments on interventions: sitting quietly for 20 mins in a private room at the physician's office is not relaxing AUTHORS CONCLUSION: Dyspnoea, anxiety and airways obstruction were reduced in the relaxation group while the control group remained the same or became worse

Risk of bias

Item	Authors' judgement	Description

Gift 1992 (*Continued*)

Allocation concealment?	Unclear	B - Unclear

Goodyer 1995

Methods	RCT Oxford Quality Scale: 2 to 0 Grade of evidence: IB Methodological quality: 14/22
Participants	N = 100, CHF Age mean (SD): intervention group 85 (5.4), control group 84 (4.5) Sex: intervention group M 24%, F 76%, control group: M 30%, F % INCLUSION CRITERIA: age over 70 years, chronic stable heart failure; no alteration of medication; responsible for administering their own medication; not regularly supervised by friends; relatives or a district nurse EXCLUSION CRITERIA: Folstein's Mental test less than 21; severe mobility disorder due to Parkinson's disease; arthritis or hemiparesis; heart condition not primary cause of shortness of breath or exercise tolerance
Interventions	INTERVENTION: n = 42, patient counselling programme at first and second meeting (correct use of their medication using a standard written protocol employing verbal counselling, medication calenders and information leaflets) CONTROL: n = 38, 2 visits on further two occasions at 2 to 4 weekly intervals
Outcomes	VAS: median (range) intervention group: baseline 169 (Q1 = 75, Q3 = 263), follow-up 140 (Q1 = 21, Q3 = 263), control group: baseline 175 (Q1 = 51, Q3 = 311), follow-up 169 (Q1 = 18, Q3 = 275). Distance to breathlessness mean (CI): intervention group baseline 85 m (114 to 56), follow-up 111 m (142 to 80), control group baseline 91 m (120 to 62), follow-up 71 m (90 to 52)
Notes	AUTHORS CONCLUSION: between group analysis of the change in VAS scores showed a significant difference, distance to breathlessness improvement for intervention group, worsening for controls

Risk of bias

Item	**Authors' judgement**	**Description**
Allocation concealment?	Unclear	B - Unclear

Gupta 2006a

Methods	RCT cross-over Oxford Quality Scale: 2 to 0 Grade of evidence: IB Methodological quality: 18/22

Gupta 2006a (*Continued*)

Participants	N = 31, COPD, FEV1 pred. 33% (SD 12). Age: mean 68 (range 49 to 84) Sex: 13 (42%) M supplemental oxygen 12 (39%) INCLUSION CRITERIA: clinical stability; moderate to severe COPD; no previously prescribed walking aid; unaided 6MW < 375 m; completed pulmonary rehabilitation programme
Interventions	INTERVENTION: two 6 MW with a minimum of 1 hour rest between the tests. 6 MW using a rollator. Test order randomly decided at baseline and then followed for each pair of tests CONTROL: unaided 6 MW
Outcomes	Modified Borg Scale mean (SE): rollator baseline 3.7 (1.5), after 4 weeks 4.0 (1.9), after 8 weeks 3.7 (1. 6); unaided baseline 4.6 (1.5), after 4 weeks (4.5 (1.6), after 8 weeks 4.4 (1.5)
Notes	AUTHORS CONCLUSION: use of rollator resulted in significant improvement in dyspnoea

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Gupta 2006b

Methods	RCT Oxford Quality Scale 2 to 0 Grade of evidence: IA Methodological quality: 19/22
Participants	N = 31, COPD all patients age mean (SD): 68 (8, range 49 - 84) Sex 42% M supplemental oxygen 39% INCLUSION CRITERIA: clinically stable, diagnosis of moderate-to-severe COPD according to American Thoracic Society criteria, completed pulmonary rehabilitation in the last year, not had previous rollator use, unassisted 6MW distance <375 m EXCLUSION CRITERIA: associated medical conditions that limited exercise tolerance, inability to communicate
Interventions	INTERVENTION: n = 18, use of rollator for 8 weeks, integrated in daily activities. Log of the days they used the rollator. CONTROL: n = 13, no rollator
Outcomes	CRQ intervention group: baseline to 4 weeks 0.23 (SE 0.35), baseline to 8 weeks 0.13 (0.36) control group baseline to 4 weeks -0.027 (SE 0.06), baseline to 8 weeks 0.036 (0.08)
Notes	AUTHORS CONCLUSION: no between-group differences in any of the domains of the CRQ

Gupta 2006b (*Continued*)

Risk of bias		
Item	**Authors' judgement**	**Description**
Allocation concealment?	Unclear	B - Unclear

Hermiz 2002

Methods	RCT Oxford Quality Scale 2 to 0 Grade of evidence: IA Methodological quality: 18/22
Participants	N = 177, follow-up 147; COPD Age mean (SD): intervention group 67.1, control group 66.7 Sex: intervention group 41 (48.8%) M, control group 43 (46.2%) M INCLUSION CRITERIA: COPD; age 30 - 80; attendance of hospital emergency department or were admitted to hospital with COPD EXCLUSION CRITERIA: residence outside the region; insufficient English speaking skills; resident in nursing home; confused or demented
Interventions	INTERVENTION: n = 84, two home visits (1 and 4 weeks after discharge from hospital) by community nurse (assessment, education, identifying problem areas) CONTROL: n = 93, usual care
Outcomes	completion of follow-up: intervention: 67, control 80 SGRQ (symptoms subscale): intervention baseline 64.5, three months 66.05, change -1.54 (-5.64 to 2. 56); control 62.97, three months 67.95, change -4.72 (-7.69 to 1.74)
Notes	AUTHORS CONCLUSION: no improvement in symptoms score in intervention group, worsening of symptom score in control group

Risk of bias		
Item	**Authors' judgement**	**Description**
Allocation concealment?	Unclear	B - Unclear

Hochstetter 2005

Methods	RCT Oxford Quality Scale 2 to 1 Grade of evidence: IA Methodological quality: 19/22

Hochstetter 2005 (*Continued*)

Participants	N = 31, one withdrew; mixed cardio-pulmonary disease Age mean (SD): intervention group 76.9 (15.4), control group 74.3 (15.6) Sex: interventions group 7 M, control group 10 M
Interventions	INTERVENTION: n = 15, 45-minute training session on physiotherapy breathlessness management including pursed lip and diaphragmatic breathing, 'blow-as-you-go', positioning and pacing techniques CONTROL: n = 15, individual meeting of investigator with patients monitoring stair climbing
Outcomes	Modified Borg Scale: intervention group: base of stairs after descent (median (IR)) day 1 7 (2), day 3 5 (4), control group day 1 7 (1), day 3 7 (3)
Notes	AUTHORS CONCLUSION: significant difference at top of stairs between days 1 and 3 and at bottom of stairs of stars after descent in intervention group

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Honeyman 1996

Methods	RCT cross-over Oxford Quality Scale: 1 to 0 Grade of evidence: IB Methodological quality: 17/22
Participants	N = 11; COPD, FEV1 pred. 29.6% (SD 7.8). Age all mean (SD) 71.3 (6.4) INCLUSION CRITERIA: 6- minute walking distance less than 300 metres EXCLUSION CRITERIA: ambulation limited by angina; claudication or arthritis rather than breathlessness
Interventions	INTERVENTION: two 6-minutes walking tests with a 1 hour rest in between, walk with wheeled walker, order randomized CONTROL: unaided walk
Outcomes	Modified Borg Scale mean (SE): wheeled walker 3.4 (0.6), unaided walk 4.7 (0.6)
Notes	AUTHORS CONCLUSION: significant increase in 6 MWT, significant reduction in breathlessness

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Jobst 1986

Methods	RCT Oxford Quality Scale 2 to 0 Grade of evidence: IB Methodological quality: 13/22
Participants	N = 26; 24 patients analysed, COPD outpatient department Age mean (SD): intervention group 67.4 (11.3, range 44-80); control group 61.5 (17.6, range 52-75) FEV1 mean (SD): intervention mean 0.81 (0.37, range 0.48-1.75); control group mean 0.74 l (0.53, range 0.35-1.58) INCLUSION CRITERIA: COPD with disabling breathlessness for at least 5 years; severely limiting exercise tolerance and compromising performance of activities of normal living (washing, shaving, dressing) EXCLUSION CRITERIA: one patient excluded as medication was changed during intervention period
Interventions	INTERVENTION: n = 12; acupuncture (according to traditional Chinese principles) combining both five-element and eight-condition theory, over three weeks, on 13 occasions, acupuncture points were inserted into acupuncture points with addition of moxibustion (burning of the herb artemesia over certain acupuncture points), stainless steel needles (1.25 to 6.25 cm length) without electrical or laser stimulation CONTROL: n = 12; same number of treatments as intervention, the needles inserted into non-acupuncture "dead" points (in an area along the middle of the knees over the patella)
Outcomes	Modified Borg Scale median (range): intervention group before intervention 4.35 (0.7 to 7.7), after 3 weeks 6.75 (0.7 to 8.3); control group before 2.3 (0.8 to 6.7), after 3 weeks 4.35 (0.7 to 7.7) Oxygen Cost Diagram median (range): intervention group before intervention 3.85 (1.0 to 6.0), after 3 weeks 5.75 (2.8 to 8.5); control group before 3.0 (2.0 to 6.7), after 3 weeks 3.85 (1 to 6) Shortness of Breath Score (1 = better than "able to keep up with people of similar age on the level but not on hills or stairs"; 5 = "breathless at rest or on minimal exertion") median (range): intervention group before intervention 3.85 (3.0 to 5.0), after 3 weeks 3.0 (1.0 to 5.0); control group before 4.3 (2.3 to 5.0) , after 3.8 (3.0-5.0) 6-min walk mean (SD, range): intervention group before intervention 227.25 (101.0; 27 to 364), after 3 weeks 304.1 (126.2; 89 to 599); control group before 204.4 (106.9; 90 to 490), after 3 weeks 231.8 (100.7; 15 to 435)
Notes	AUTHORS CONCLUSION: real-acupuncture group significantly greater benefit than the placebo group in all subjective scores and in the distance walked in six minutes

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Ketelaars 1998

Methods	controlled pretest/posttest study Oxford Quality Scale 1 to 0 Grade of evidence: II B Methodological quality: 12/22
Participants	N = 115, 78 completed COPD, FEV1 pred. % mean (SD): intervention group 41 (14), control group 38 (16) Age mean (SD): intervention group 64 (10), control group 64 (8) Sex: intervention group 75% M, control group 74% M INCLUSION CRITERIA: diagnosis of COPD according to American Thoracic Society (ATS) guidelines; being 40 to 80 years of age; not receiving help with activities of daily living from health care professionals- EXCLUSION CRITERIA: other severely disabling illnesses unrelated to respiratory illness, such as cardiovascular, neurologic, and locomotor diseases; patients not discharged to their home
Interventions	INTERVENTION: n = 39, regular home visits by specialized nurses who received in-service training in the area of respiratory diseases and treatment: pathology, diagnosis, medication and oxygen administration, rehabilitation regimens, psychosocial problems, and after-care home visiting CONTROL: n = 39, regular home visits by general nurses without specialist training
Outcomes	SGRQ symptom subscale: intervention group: pretest 2 53 (24), after 4 months 61 (23), after 9 months 59.25 (23); control group pretest 2 54 (19), after 4 months 58 (23), after 9 months 62.27 (18)
Notes	AUTHORS CONCLUSION: postrehabilitation specialised respiratory nursing care did not demonstrate superior results regarding HRQL (SGRQ including symptom subscale). HRQL improved between admission and discharge but deteriorated 4 and 9 months after discharge

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Lange 2006

Methods	RCT Oxford Quality Scale: 2-1 Grade of evidence: IB Methodological quality: 17/22
Participants	N = 46, MND Age all patients mean (SD): 58.9 (9.7, range 35 to 76) Sex: intervention group 11 M, 11 F, control group 10 M, 14 F Vital capacity: intervention group mean (SD) 64.2% (11.2), control group 68.2% (16.3) INCLUSION CRITERIA: ALS with respiratory symptoms (ALSFRS-RS score = < 11); not participating in any other trial EXCLUSION CRITERIA: ALSFRS-RS score = < 5; previous use of HFCWO; FVC < 40% expected; prior or present tracheostomy; use of a cough assist device; congestive heart failure or other contraindications for HFCWO (unstable neck injury, hemodynamic instability)

Lange 2006 (*Continued*)

Interventions	INTERVENTION: n = 22, the first HFCWO use occurred under the observation of the respiratory therapist. HFCWO system consisted of an inflatable vest connected by two tubes to a remote air pulse generator. The air pulse generator rapidly inflates and deflates the vest compressing and releasing the chest wall at a frequency and pressure designated by settings on the machine. Patients used the device 10 to 15 minutes per treatment, with two treatment sessions daily, in a sitting position. CONTROL: n=24, no treatment
Outcomes	Modified Borg scale: intervention group: mean change (SD) -1.28 (2.64), control group: mean change 0. 84 (2.54). ALSFRS-RS proportion showing worsening: intervention group 36.8%, control group 37.5%
Notes	AUTHORS CONCLUSION: HFCWO users had significantly less breathlessness and coughed more at night

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Yes	A - Adequate

Lewith 2004

Methods	RCT, cross-over Oxford Quality Scale 2 to 1 Grade of evidence: IA Methodological quality: 15/22
Participants	N = 36 (33 with COPD, 1 pulmonary fibrosis, 2 cystic fibrosis), home care Age: range 24 to 83 years (mean 66.6; SD 13.4) Sex: 16 M (44%)/20 F (56%) INCLUSION CRITERIA: COPD; cystic fibrosis; pulmonary fibrosis; breathlessness > 60 mm VAS EXCLUSION CRITERIA: known clotting disorder; on anticoagulants; pregnancy WITHDRAWAL CRITERIA: if they desired; interference with routine medical management; acute respiratory infection; commenced treatment with steroids
Interventions	INTERVENTION: n = 16, 12 patients completing phase 2; insertion of 4 fine needles, 2 in upper sternum 1 to 2 cm apart (Ren 20 and 21), one in each hand (large intestine 4), needles left in situ for 20 min and then removed; 10 min later 2 in-dwelling studs placed in sternal points; pats instructed to massage the studs as many times as they wish during the day, total 6 treatment sessions, treatment during week 2, 4 and 6, each treatment period 5 days duration, followed by 9-days wash-out period CONTROL: n = 16, 12 patients completing phase 2; Mock TENS: transcutaneous electroconductive pads applied to on skin over two sternal points for 20 min.; pads connected to TENS machine that emitted visual sign, but no current could pass to patient; no pressed studs were inserted subsequent to treatment
Outcomes	Data collection: baseline, after 3 weeks treatment wash-out period, in the second week of wash-out further baseline, at end of each treatment week patients daily diary forms VAS worst breathlessness: acupuncture/TENS group mean (SE, 95% CI): baseline mean 73.4 (2.5 CI 68.4 to 78.4); acupuncture 69.0 (5.0 CI 59.0 to 79.0); washout 64.5 (6.1 CI 52.3 to 76.7); mock TENS

	59.0 (6.7 CI 45.6 to 72.4); TENS/acupuncture group: baseline 72.3 (2.4 CI 67.5 to 77.0); Mock TENS 67.3 (4.1 CI 59.1 to 75.5); washout 67.7 (4.5 CI 58.7 to 76.7); acupuncture 62.0 (5.2 CI 51.3 to 72.7) Mean changes in VAS worst breathlessness: acupuncture /TENS group: phase I (acupuncture) mean 8. 9 SE 4.54 CI -0.45 to 18.25; phase II (Mock TENS) mean 4.94 SE 3.42 CI -2.11 to 11.98; TENS/ acupuncture group: phase I (Mock TENS) mean 4.73 SE 3.29 CI -2.05 to 11.51; phase II (acupuncture) mean 9.54 SE 4.17 CI 0.95 to 18.13
Notes	Side effects: 3 patients reported minor transitory bruising or pain after acupuncture Drop outs: 4 patients in baseline phase because of intercurrent infections or increased steroids

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Yes	A - Adequate

Louie 2004

Methods	RCT Oxford Quality Scale: 2 to 1 Grade of evidence: IB Methodological quality: 16/22
Participants	N = 31, 5 unable to complete protocol (medical condition, unwilling/unable relaxation session), COPD Age mean (SD): intervention group 72.92 (7.41), control group 72.38 (6.42) Sex: both groups M 12/ F 1 FEV1/FVC % mean (SD): intervention group 49.3 (10.24), control group 41.51 (7.19) INCLUSION CRITERIA: symptoms of dyspnoea, no prior experience of guided imagery relaxation training
Interventions	INTERVENTION: n = 13, six practice sessions: dimmed light, quiet atmosphere, foam-padded reclined chair for each participant, relaxation tape played through headset (therapist's instructions on how to conduct a pleasant mental picture and how to incorporate abdominal breathing with the relaxation training. Soft music in the background of the tape CONTROL: n = 13, six practice sessions: dimmed light, quiet atmosphere, foam-padded reclined chair for each participant, instruction to sit quietly
Outcomes	Measurement before and after seventh session Modified Borg Scale: U = 78.00, P = 0.626 oxygen saturation: F= 4.956, df=1, P< 0.05 heart rate: F = 0.29, df = 1, P = 0.595
Notes	Patients comments on interventions: sitting quietly for 20 mins in a private room at the physician's office is not relaxing AUTHORS CONCLUSION: No significant difference in the rate of perceived dyspnoea was noted between the two groups

Risk of bias

Louie 2004 (*Continued*)

Item	Authors' judgement	Description
Allocation concealment?	Yes	A - Adequate

Maa 1997

Methods	RCT, cross-over Oxford Quality Scale 2 to 1 Grade of evidence: IB Methodological quality: 17/22
Participants	N = 31, COPD Age: mean 67.3 years (SD 8.17); male = 19, female = 12; 13 patients with oxygen therapy, 5 with supplemental oxygen during PRP sessions; 21 patients > 30 of 36 possible rehabilitation sessions Setting: Hospital INCLUSION CRITERIA: 19 years or older, COPD, beginning a 12-week pulmonary rehabilitation programme, able to speak English, learn to self-administer acupressure or have a caretaker willing to learn to administer acupressure
Interventions	INTERVENTION: n = 19; group 1 acupressure for 6 weeks, then sham acupressure for 6 weeks; acupressure on seven acupoints; subjects instructed to apply gentle but firm pressure to the acupoint using one or two fingers to produce a sense of balance between pain and pleasure, instruction to massage each of the 7 bilateral acupoints in any order, using a small circular movement of about 2 or 3 cycles per second for 1 or 2 minutes per acupoint; at least once per day or whenever they had symptoms or wished to do so CONTROL: n = 12; group 2 sham acupressure for 6 weeks then acupressure for 6 weeks: sham acupressure to seven points that are not documented true acupoints, same technique
Outcomes	Preintervention and postintervention outcome measurements during weeks 1, 6 and 12. VAS breathlessness: baseline mean 58.48 (SD 18.46, range 95 to 17); after acupressure mean 43.43, after sham acupressure mean 48.97; VAS difference sham-real mean 5.54; mean value adjusted for co-variables difference 8.54, P = 0.009 Borg scale: baseline mean 3.52 (SD 1.41, range (0-7); after acupressure mean 3.27, after sham acupressure mean 3.32; Borg difference sham-real 0.05, mean value adjusted for co-variables difference 0.05, P = 0. 388 BESC Dyspnoea Scale: baseline mean 48.56 (SD 7.51, range 66 to 31); after acupressure mean 44.24, after sham acupressure 45.10; BESC dyspnoea difference sham-real 0.86, mean value adjusted for co-variables difference 0.58, P= 0.235
Notes	Side-effects: none of the patients experienced bruising or other adverse skin reactions Withdrawals/drop-outs: 20 enrolled subjects did not complete study (6 hospitalization, 3 clinical problems, 3 lung volume reduction surgery, 8 voluntary withdrawals) AUTHORS CONCLUSION: Real acupressure was more effective than sham acupressure for reducing dyspnoea

Risk of bias

Item	Authors' judgement	Description

Maa 1997 (*Continued*)

Allocation concealment?	Unclear	B - Unclear

McMillan 2007

Methods	RCT Oxford Quality Scale: 1 to 1 Grade of evidence: IB Methodological quality: 15/22
Participants	N = 329, hospice home care patients with cancer and their caregivers Age (mean, SD): COPE 70.84 (10.99), Support 71.02 (12.12), control 70.12 (12.58) Sex: COPE group F 37%, support group F 39%, control group F 44% PPS mean (SD) COPE 54.5 (7.88), support 52.57 (11.09), control 51.42 (9.96) INCLUSION CRITERIA: diagnosis of cancer, identified family caregiver, both had to consent, patients and caregivers at least sixth-grade education and be able to read and understand English, minimum score of 7 on Short Portable Mental Status Questionnaire, Palliative Performance Scale min. 40 EXCLUSION CRITERIA: if not two of the symptoms pain, dyspnoea, constipation as documented by baseline data collection
Interventions	INTERVENTION: n = 111, COPE Problem-based Coping Intervention for carers (creativity, optimism, planning, expert information); written information (Home Care Guide for Advanced Cancer), three visits over nine days (visit 1 = 45 min, visits 2 to 3 = 30 min each), demonstration of COPE intervention problem-solving principles in caring for a patient with cancer, phone calls to caregivers between each of the intervention visits SUPPORTIVE GROUP: n = 108, standard care from the hospice staff plus friendly visits made on the same schedule and lasting as long as COPE intervention group CONTROL: n = 109, standard care from the hospice staff
Outcomes	Dyspnoea intensity scale (0 to 10): random-effects model intercept estimate 2.807 (SE 0.426)
Notes	AUTHORS CONCLUSION: dyspnoea intensity did not show concomitant improvement

Risk of bias

Item	**Authors' judgement**	**Description**
Allocation concealment?	Yes	A - Adequate

Moore 2002

Methods	RCT Oxford Quality Scale: 2 to 0 Grade of evidence: IA Methodological quality: 18/22

Moore 2002 (*Continued*)

Participants	N = 203, lung cancer Setting: Hospital Age mean (SD): both groups 67 years (8.8, range 45 to 89) Sex: intervention group M 74 (75%), control group M 66 (64%) Diagnosis (%): intervention group non-small cell lung cancer 74 (75), limited small cell lung cancer 8 (8), extensive small cell lung cancer 6 (6), mesothelioma = 8 (8), no histology 3 (3); control group non-small cell lung cancer 73 (71), limited small cell lung cancer 9 (9), extensive small cell lung cancer 12 (12) , mesothelioma 6 (6), no histology 3 (3) Disease stage (%): intervention group Stage I or II =12 (12%), IIIa = 14 (14), IIIb = 28 (28), IV = 19 (19), none = 14 (14), mesothelioma = 8 (8), not known = 4 (4), control group I or II = 14 (14), IIIa = 7 (7), IIIb = 36 (35), IV = 19 (18), none = 21 (20), mesothelioma = 6 (6), not known = 0 WHO Performance status (%): intervention group normal activity = 8 (8), strenuous activity restricted, can do light work = 59 (60), up & about > 50%, capable of self care= 32 (32); control group normal activity = 4 (4), strenuous activity restricted, can do light work = 64 (82), up & about > 50% , capable of self care = 35 (34) Median survival time: intervention group 9.2 months (95% CI 6.2 to 12.1); control group 10.4 months (95% CI 7.6 to 13.2) INCLUSION CRITERIA: Patients with lung cancer who had completed their initial anticancer treatment and were expected to survive for at least three months were invited to participate EXCLUSION CRITERIA: ineligible, if they were receiving cancer treatment, were having close medical supervision or had a poor prognosis or performance status
Interventions	INTERVENTION: n = 100 (99), 1 patient randomised was found to be ineligible and excluded; patients have open access to nurse specialists Monday to Friday and contact through open access clinic, telephone, and message pager service; telephone assessment or clinic appointment two weeks after baseline, then every four weeks while patient is stable; no routine investigations; clinic assessment form to be completed at each clinic appointment or telephone assessment; weekly, open access nursing clinics at the three study sites; short notice (same day) appointment system available. Emphasis on rapid and comprehensive communication with general practitioner and primary healthcare team by telephone, fax, or letter, as appropriate Regular discussion with and referral to medical team on detection of any new symptom or rapid worsening of condition Documentation from nurse led clinic was held in notes and sent to general practitioner, home care team or hospice, if applicable, and consultant in charge of patient CONTROL: n = 103; routine outpatient appointments (1 post-treatment, then appointments at 2 to 3 month intervals) for medical assessment and investigations to monitor disease progression. Patients also seen on basis of need
Outcomes	EORTC core questionnaire dyspnoea at baseline, 3, 6, 12 months after randomisation median (range): intervention group 25.0 (16.7 to 41.7) - 33.3 (19.4 to 58.3) - 25 (14.6 to 50.0), control group 33.3 (25. 0 to 58.3) - 37.5 (16.7 to 58.3) - 50 (20.8 to 58.3); Physical, role, emotional, cognitive, social functioning, pain, fatigue, appetite: no significant differences between groups throughout the whole study period besides emotional functioning and peripheral neuropathy significant better after 12 months in intervention group. Patient satisfaction (organisation of care, information and advice, personal experience of care, satisfaction with care) significantly better in intervention group after 3, 6 and 12 months besides satisfaction with care after 6 months and 12 months and overall rate of support after 12 months

Moore 2002 (*Continued*)

Notes	AUTHORS CONCLUSION: Nurse led follow up was acceptable to lung cancer patients and general practitioners and led to positive outcomes (less dyspnoea)

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Yes	A - Adequate

Nakayama 1998

Methods	RCT, cross-over Oxford Quality Scale 1 to 0 Grade of evidence: IB Methodological quality: 16/22
Participants	N = 9, COPD Age mean (SD) 68 (6) Sex: 8 M, 1 F FEV1: 0.98 l (0.39) INCLUSION CRITERIA: not mentioned EXCLUSION CRITERIA: not mentioned
Interventions	INTERVENTION: arm exercise (arms straight above their head while holding weights (1 to 1.5 kg) for 3 minutes) with inphase chest wall vibration (two upper vibrators, attached bilaterally at the second or third intercostal spaces in the parasternal region, vibration during inspiratory phase, two lower vibrators, attached bilaterally on the anterior axillary lines at the seventh to ninth intercostal spaces, vibration during expiratory phase CONTROL: arm exercise without chest wall vibration
Outcomes	mod. Borg scale: intervention group 2.1 (1.2), control group 3.3 (1.2)
Notes	AUTHORS CONCLUSION: Inphase chest wall vibration decreased dyspnea during lifting weights straight above the head, but did not affect arm fatigue

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Neder 2002

Methods	RCT Oxford Quality Scale: 1 to 0 Grade of evidence: IB Methodological quality: 19/22
Participants	N = 15, moderate to severe COPD, breathlessness MRC scale 4 and 5 All patients: clinical and functional diagnosis of COPD with moderate to severe ventilatory impairment and incapacitating breathlessness (Medical Research Council scores 4 ("I stop for breath after walking 100 yards or after a few minutes on the level") or 5 ("I am too breathless to leave the house"). Age: intervention group 66.6 (7.7), control group 65.0 (5.4) FEV1 pred. %: intervention group 38.0 (9.6), late intervention group 39.5 (13.3) BMI: intervention group 24.8 (6.9), late intervention group 25.6 (8.8) INCLUSION CRITERIA: absence of associated locomotor or neurological conditions; disease stability as indicated by no change in medication dosage or exacerbation of symptoms in the preceding 4 weeks
Interventions	INTERVENTION: n = 9, portable, user friendly, dual channel NME stimulator applied at home on each leg (15 minutes in the first week and 30 minutes thereafter), in sequence, five times per week for 6 weeks (a total of 30 sessions) LATE INTERVENTION : n = 6, 6 week control period, then 6 week treatment period
Outcomes	CRQ dyspnoea: mean difference between intervention and late intervention group 1.2 (95%CI 0.4 to 2. 0), before and after late intervention group 1.4 (95% CI 0.5 to 2.3). No between group differences observed in fatigue, emotional function, mastery
Notes	Side effects: no reports of side-effects in patients diaries such as pain or discomfort, virtual absence of ventilatory stress during passive exercise, reflecting the smaller muscle mass involved AUTHORS CONCLUSION: For severely disabled COPD patients with incapacitating dyspnoea, short term electrical stimulation of selected lower limb muscles involved in ambulation can improve muscle strength and endurance, whole body exercise tolerance, and breathlessness during activities of daily living

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Pfister 1998

Methods	RCT, cross-over Oxford Quality Scale: 2 to 0 Grade of evidence: IB Methodological quality: 19/22
Participants	N = 20; 19 patiens completed all tasks and where included in analysis, COPD Age mean (SD): 71.9 (7.8) Sex: M 11/F 8 FEV1 predicted % mean (SD): 40 (11) INCLUSION CRITERIA: clinical diagnosis of mild to severe COPD, confirmed by history, physical

Pfister 1998 (*Continued*)

	examination and spirometry (emphysema, chronic bronchitis, asthmatic bronchitis); attending pulmonary rehabilitation at least 1 month and exercising regularly on the treadmill EXCLUSION CRITERIA: restrictive lung disease
Interventions	INTERVENTION: n = 11 music first, first session: 4-minute practice walk , second and third walk as fast as possible listening to music during the walk CONTROL: n = 8 without music first, first session: 4-minute practice walk, second and third walk as fast as possible without music
Outcomes	Perceived dyspnoea after 6 min. walk mean (SE): with music 5.1 (0.54), without music 4.8 (0.47) (data calculated from graph)
Notes	AUTHORS CONCLUSION: no statistically significant differences observed between treatment conditions for distance walked, perceived dyspnoea or ratings of perceived exertion. 60% of subjects voluntarily commented that they enjoyed listening to music while they exercised

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Probst 2004

Methods	RCT, cross-over Oxford Quality Scale: 2 to 0 Grade of evidence: IB Methodological quality: 19/22
Participants	N = 15, 14 analysed; COPD (1 mild, 5 moderate, 6 severe, 22 very severe) Age: median 70 years (range 65 to 76) Sex: M 9/F 5 FEV1 predicted median (IQR): 45% (33 to 67) INCLUSION CRITERIA: no locomotory, neurologic condition or disability limiting the ability to walk; no need for oxygen supplementation during the 6 MWT; familiarity with the 6 MWT; naivety to the use of walking aids
Interventions	INTERVENTION: first 6 MWT practice walk with the rollator; then two tests with portable metabolic system, one with rollator, other one without in random order. Height of handlebars adjusted at the level of the ulnar styloid process CONTROL: walk without rollator
Outcomes	Modified Borg Scale median (inter quartile range IQR): with rollator 5 (4 to 7); without rollator median 6 (4 to 7) Fatigue on Borg Scale median (IQR): with rollator 4 (3-5); without rollator 5 (4-7) Walking distance median (IQR): with rollator 462 m (424 to 477); without rollator 416 m (396 to 435)

Probst 2004 (*Continued*)

Notes	AUTHORS CONCLUSION: The use of a rollator improves walking distance of patients with COPD though an increased ventilatory capacity and/or better walking efficiency. Dyspnoea tended to be lower with a rollator

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Rabow 2004

Methods	RCT Oxford Quality Scale: 2 to 0 Grade of evidence: IA Methodological quality: 15/22
Participants	N = 90, cancer (n = 30), COPD (n = 29), CHF (n = 31) Age mean (SD): intervention group 67.9 (13.9), control group 69.4 (11.2) Sex (F%): intervention group 74%, control group 52% INCLUSION CRITERIA: diagnosis of advanced cancer, advanced COPD or advanced CHF; believed life expectancy of 1 to 5 years not yet ready for hospice care EXCLUSION CRITERIA: nonmelanoma skin cancer, dementia, psychosis, enrolled in hospice care, unable to complete a written survey in English or Spanish
Interventions	INTERVENTION: n = 50, comprehensive care team: social worker, nurse, chaplain, pharmacist, psychologist, art therapist, volunteer coordinator, 3 physicians; primary care physicians consultation, case management, volunteer and group support, chaplaincy consultation, artistic expression; CONTROL: n = 40, usual primary care
Outcomes	UCDS-SOB: dyspnoea interferes score (0 to 105) intervention group baseline 44.8, 6 months 32.6, 12 months 25.4; control group baseline 36.1, 6 months 40.3, 12 months 40.6; UCDS dyspnoea limits score intervention group: baseline data not valid, 6 months 5.8, 12 months 3.6, control group baseline data not valid, 6 months 6.5, 12 months 7.1
Notes	AUTHORS CONCLUSION: intervention group patients had less dyspnoea

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Rea 2004

Methods	controlled trial, cluster randomisation of GP practices Oxford Quality Scale: 2 to 1 Grade of evidence IA Methodological quality: 19/22
Participants	N = 135, 117 completed study, moderate - severe COPD all patients: age 68 (range 44 to 84) Sex: 56 M/79 F Comorbidities 2.3 (mean) INCLUSION CRITERIA: COPD by ICD-9-CM codes and GP records for clinical diagnoses of moderate to severe COPD EXCLUSION CRITERIA: Chronic asthma; bronchiectasis; comorbidity more significant than COPD; unable to give informed consent; prognosis < 12 months; LTOT or too unwell; GP practice exclusion criteria: no longer enrolled with participating GP practice or moved out of area; unable to contact patient, insufficient PN resource
Interventions	INTERVENTION: n = 83, chronic disease management programme by GP and practice nurse, supported by respiratory physician and respiratory nurse specialist: care plan with set goals, action plan, smoking cessation, inhaler technique, medication review, flu vaccination, pulmonary rehabilitation programme; visits: monthly practice nurse, 3 monthly GP, at least one home visit by respiratory nurse specialist and one following hospital admission CONTROL: n = 52, conventional care: access to COPD-management guideline, access to pulmonary rehabilitation programme
Outcomes	Dyspnoea CRQ: intervention group baseline 17.3, follow-up (12 months) 18.0, control group baseline 16.3, follow-up 16.0 Mastery (CRQ): intervention group baseline 18.9, follow-up 20.4; control group: baseline 20.1, follow-up 20.7
Notes	AUTHORS CONCLUSION: no improvement in dyspnoea, significantly greater improvement in mastery and fatigue, reduction in hospital days for respiratory admissions

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Renfroe 1988

Methods	RCT Oxford Quality Scale: 2 to 0 Grade of evidence: IB Methodological quality: 13/22
Participants	N = 20, only 14 completed all session, COPD Age mean 61 Sex: M 10/F 10 FEV1 predicted % 46.1, 50% severely impaired, 25% moderately impaired, 25% mildly impaired

Renfroe 1988 (*Continued*)

	INCLUSION CRITERIA: diagnosis of bronchial asthma, chronic bronchitis, emphysema or all of these; dyspnoea on exertion; absence of serious medical problems other than COPD; absence of acute disorders at this time (such as pneumonia or urinary tract infection)
Interventions	INTERVENTION: n = 7, instructions on progressive muscle relaxation (PMR) according to a script: tension release in 16 muscle groups (tense each muscle 5 to 10 sec while inhaling, holding breath, relax while exhaling), each session 45 min. Three weekly sessions, daily home practice (practice procedure once daily with script of instructions and tape recording of script), overall four sessions to provide an additional week of training CONTROL: n = 7, instruction to relax for 45 min. in any way they wished, no more than 3 patients in one room
Outcomes	Data collection before and after each session VAS dyspnoea during each session: mean difference 2.4 (SD 2.4); intervention group 2.27, control group 1.03, P = 0.04 VAS dyspnoea from beginning of first session to end of fourth session: mean change score intervention group 1.9 (SD 3.4), control group -0.8 (SD 2.3) Spielberger's State Anxiety Inventory (STAI) from beginning to end of each session: mean difference 6.5 (P = 0.001); intervention group 8.18, control group 1.67 (P = 0.001) Spielberger's State Anxiety Inventory (STAI) from beginning of first session to end of fourth session: mean 7.1 (SD 11.0) ; mean change score intervention group 7.1 (SD 11.0), control group 1.7 (SD 9.5)
Notes	AUTHORS CONCLUSION: PMR was shown to be more effective than the control in reducing dyspnoea, anxiety, respiratory rate and heart rate during each session, but only respiratory rate at the end of the 4-week period

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Rosser 1983

Methods	RCT Oxford Quality Scale: 2 to 0 Grade of evidence: IB Methodological quality: 20/22
Participants	N = 65, COPD outpatient INCLUSION CRITERIA: dyspnoea due to COPD EXCLUSION CRITERIA: presence of another severe illness or a cause of dyspnoea other than COAD; living too far away to take part in the study; inability to understand English; dementia detected clinically or by screening questionnaire; other conditions which were a contradiction to psychotherapy
Interventions	INTERVENTION: eight 45-min sessions (tape-recorded and transcribed) 1. analytic group (n = 16): psychoanalyst, free use of transference interpretations

Rosser 1983 (*Continued*)

	2. supportive group (n = 16): psychoanalyst, no transference interpretation, but engaging patient in dynamic interaction 3. nurse group (n = 16): experienced medical nurse without psychotherapeutic training; concentration on practical realities groups of 10 to 13, seen for 8 months (including 2 months therapy, assessment a week before and a week after therapy, 6-months follow-up) CONTROL: weekly laboratory tests, n = 17
Outcomes	VAS dyspnoea (median) start - after intervention - follow-up (6 months): analytic 52 - 43 - 47, supportive 58 - 63 - 65, nurse 38 - 46 - 49, control 62 - 50 - 56 MRC dyspnoea scale (median) start - after intervention - follow-up (6 months): analytic 3.0 - 3.1 - 3.0, supportive 3.4 - 3.4 - 4.0, nurse 3.2 - 2.9 - 2.9, control 3.2 - 3.3 - 3.2 VAS depression (median) start - after intervention - follow-up (6 months): analytic 7 - 29 - 10, supportive 8 - 11 - 17, nurse 7 - 8 - 12, control 20 - 22 - 10 VAS anxiety (median) start - after intervention - follow-up (6 months): analytic 20 - 17 - 23, supportive 10 - 23 - 19, nurse 14 - 17 - 13, control 56 - 20 - 12 Quality of life (General Health Questionnaire) (median) start - after intervention - follow-up (6 months) : analytic 4.5 - 2.5 - 7.5, supportive 5.5 - 1.5 - 2.5, nurse 5.2 - 2.5 - 3.5, control 7.7 - 3.0 - 4.0
Notes	Patients comments on interventions: Observation: patients were deeply engaged in therapeutic work. But patients expectations as a whole were disappointed and they tended to correlate negatively with a change in the GHQ score. Cost effectiveness: Saving if the 17 patients in the control group had received therapy, would have been approximately £5250 for psychoanalytical treatments and £6250 for nurse treatment AUTHORS CONCLUSION: The group treated by a medical nurse without training in psychotherapy experienced sustained relief of dyspnoea but tended to undergo less psychodynamic change

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Sibuya 1994

Methods	RCT, cross-over Oxford Quality Scale: 1 to 0 Grade of evidence: IB Methodological quality: 17/22
Participants	N = 15, 12 COPD, 3 sequelae of pulmonary tuberculosis all patients clinically stable, no signs of infection or right heart failure Age mean (SD): 68.3 (6.2) baseline dyspnea (150 mm VAS): 17.9 (3.3) INCLUSION CRITERIA: not mentioned EXCLUSION CRITERIA: not mentioned

Sibuya 1994 (*Continued*)

Interventions	INTERVENTION: in-phase vibration (IPV): inspiratory intercostal muscles vibrated during inspiration and expiratory intercostal muscles vibrated during expiration; 2 vibrators attached bilaterally on second and third interspaces in parasternal region of upper chest wall. 2 additional vibrators attached bilaterally at seventh to ninth interspaces anterior to the midaxillary line in the lower chest wall CONTROL: out-of-phase vibration (OPV): inspiratory intercostal muscles vibrated during expiration and expiratory muscles vibrated during inspiration; 2 vibrators attached bilaterally on second and third interspaces in parasternal region of upper chest wall. 2 additional vibrators attached bilaterally at seventh to ninth interspaces anterior to the midaxillary line in the lower chest wall
Outcomes	VAS (150 mm): IPV: average change -6.9 mm, 95% CI (-12.9 to -0.9); OPV average change + 21.9 mm; 95% CI 5.1 to 38.7 mm
Notes	AUTHORS CONCLUSION: IPV decreases and OPV increases dyspnea at rest in patients with severe and chronic respiratory diseases

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Sidani 2004

Methods	RCT, cross-over Oxford Quality Scale: 1 to 0 Grade of evidence: IB Methodological quality: 10/22
Participants	N = 26, COPD all patients age mean (SD): 72 (9) disease stage: COPD for about 10.5 years (SD 7.2), 2/3 dyspnoea every day, Borg mean score 5, severity increased by a mean score of 4.5 (SD 1.7) INCLUSION CRITERIA: confirmed medical diagnosis of COPD, speak and read English, reported experiencing dyspnoea at least once a week, demonstrated an increase in the level of perceived dyspnoea of at last 2 points on the Borg scale following a 6 minutes walk test
Interventions	INTERVENTION: 12/26 first, resting with music: to sit in a comfortable chair, put on the headphones, place the walkman in a convenient location, listen to selected music for 20 minutes and focus the mind on the music and close the eyes if desired CONTROL: 14/26 first, resting only: to sit in a comfortable chair for 20 minutes and close their eyes if desired
Outcomes	Modified Borg scale mean (SD): intervention group baseline 0.68 (1.21), pretest 4.35 (2.23), posttest 0. 56 (1.27), control group baseline 0.78 (1.3), pretest 3.75 (2.28), posttest (0.83 (1.39)
Notes	AUTHORS CONCLUSION: resting only and resting while listening to music were effective in reducing exercise-induced dyspnoea

Sidani 2004 (*Continued*)

Risk of bias		
Item	**Authors' judgement**	**Description**
Allocation concealment?	Unclear	D - Not used

Solway 2002

Methods	RCT, cross-over Oxford Quality Scale: 1 to 1 Grade of evidence: IA Methodological quality: 22/22
Participants	N = 40, COPD Outpatient Age mean (SE): 67.7 (1.2) Sex M 21/F 19 FEV1 predicted mean (SE): 36.1% (2), 10 patients with supplemental oxygen INCLUSION CRITERIA: COPD; clinically stable; between 55 and 85 y; unaccustomed of a walking aid EXCLUSION CRITERIA: presence of associated medical conditions that limited exercise tolerance; inability to communicate English
Interventions	INTERVENTION: two 6MWTs with a minimum 1-h rest between tests; one 6MWT unaided and the other with rollator (height adjusted that handle bars were on level of subjects ulnar styloid process); test order randomized for first day and reversed on second day
Outcomes	19/40 subjects walked < 300 during the unaided 6 MWT. Modified Borg Scale mean (SE): total sample with rollator (WR) 1.8 (0.2), no rollator (NR) 2.7 (0.3); subjects who walked < 300 m unaided WR 1.8 (0.3), NR 3.2 (0.4), subjects who walked > 300 m unaided WR 1.7 (0.2), NR 2.2 (0.3) 6 MWT mean (SE): total sample WR 317 m (15.7), NR 311.6 (16.6); subjects who walked < 300 m unaided WR 242.5 m (14.2), NR 220.3 (12); subjects who walked > 300 m unaided WR 242.5 m (14.2), NR 220.3 (12); subjects who walked > 300 m unaided WR 384.4 (16.4), NR 394.3 (13.9) Duration of rest mean (SE): WR 11.9 sec. (5.8), NR 31.2 sec. (8.7) Subjective preference: 50% preferred walking with rollator, 17.5% no preference, 32.5% preferred to walk unaided
Notes	Patients comments on interventions: breathe easier 73.7% of subjects who walked < 300 m strongly agree, breathe easier 52.4% of subjects who walked > 300 m strongly agree AUTHORS CONCLUSION: Use of a rollator was effective in improving functional exercise capacity by reducing dyspnea and rest duration among stable individuals with severe COPD. Individuals who walked < 300 m and individuals who required a rest during an unaided 6MWT benefited the most from using a rollator in terms of reduced dyspnea, reduced rest time, and improved distance walked
Risk of bias	

Solway 2002 (*Continued*)

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Vickers 2005

Methods	RCT Oxford Quality Scale 2 to 1 Grade of evidence: IA Methodological quality: 20/22
Participants	N = 47, lung and breast cancer Age mean (SD): intervention group 63 (12.8), control group 67 (11.4) Sex mean (SD): intervention group F 60%, control group F 65% INCLUSION CRITERIA: age > 18; subjective complaint of shortness of breath and ATS Breathlessness Scale > 2; steroid medication min. 48 h pursued EXCLUSION CRITERIA: shortness of breath predated cancer diagnosis; recent onset of symptoms (< 7 d); anemia; recent acupuncture; contraindications to acupuncture; planned initiation or change in oncologic therapy or symptomatic management of breathlessness; likelihood of patients death during trial period; primary cause of dyspnoea: CHF, sarcoid disease, hypersensitivity pneumonitis, pneumothorax, chest wall deformity, obesity, neuromuscular disorder, pulmonary vascular disease, hepatomegaly, phrenic nerve paralysis. If primary cause of dyspnoea was ascites, effusion, pneumonia, large airways obstruction, supra vena cava obstruction or pulmonary embolism, patients only eligible, if shortness of breath despite conventional therapy
Interventions	INTERVENTION: n = 25; true acupuncture (single treatment, needles applied for 15 min) and true acupressure (1 h after removal of needles, acupressure studs = intradermal acupuncture needles, also 1 placebo stud), patients applied pressure to the stud by making small circular movements with fingers (2 to 3 cycles per second for 1 to 2 min per point) CONTROL: n = 20; placebo acupuncture (single treatment, needles applied for 15 min, placebo needles consist of blunted needle that moves up inside its handle instead into the skin) and placebo acupressure (placebo studs without needles, also 1 true stud), pts applied pressure to the stud by making small circular movements with fingers (2 to 3 cycles per second for 1 to 2 min per point)
Outcomes	Data collection: every 15 minutes for 75 minutes immediately before acupuncture treatment and one hour immediately after, daily diary for seven days NRS immediately post-treatment: Intervention group before mean 4.09 (SD 2.32), one hour after intervention mean 3.36 (SD 2.21); control group before mean 3.41 (SD 2.79), one hour after placebo 2.42 (SD 2.64) NRS immediately post-treatment (pre-treatment score > 2): intervention group before mean 4.87 (SD 1.92), one hour after intervention mean 3.99 (SD 2.03); control group before mean 5.28 (SD 2.18) , one hour after placebo 3.92 (SD 2.5) NRS seven day breathlessness diary: Intervention group before mean 6.58 (SD 1.71), one hour after intervention mean 5.07 (SD 2.12); control group before mean 5.99 (SD 1.71), one hour after placebo 3.77 (SD 2.39)
Notes	AUTHORS CONCLUSION: the acupuncture technique used in this trial is unlikely to have effects on dyspnoea importantly larger than placebo for patients with advanced cancer

Vickers 2005 (*Continued*)

Risk of bias		
Item	**Authors' judgement**	**Description**
Allocation concealment?	Yes	A - Adequate

Vivodtzev 2006

Methods	RCT Oxford Quality Scale 1 to 0 Grade of evidence: IB Methodological quality: 20/22
Participants	N = 17, severe COPD FEV1 pred. 30 (3)%, body mass index 18 (2.5) kg/m² Age: intervention group 59 (15), control group: 68 (12) INCLUSION CRITERIA: severe bronchial obstruction (i.e., COPD and/or bronchiectasis) but no evidence of cardiovascular, renal, or hepatic diseases; FEV1 < 50% pred. with an FEV1/FVC ratio of < 70%; disability and malnutrition as established by a BMI of < 22 kg/m²; quadriceps muscle atrophy (i.e., isometric maximal voluntary contraction of < 50% predicted); inability to perform cycle exercise or extremely limited (i.e., <3 to 5 min) exercise tolerance at the lowest workloads (i.e., < 20 W); the ability to perform experimental maneuvers; all patients were recruited after a sojourn in an ICU and/or after an acute exacerbation that required hospitalization, while they were subsequently admitted for 1 month as inpatients in the pulmonary rehabilitation center; no acute respiratory failure at the time of the study; a signed informed consent form
Interventions	INTERVENTION: usual rehabilitation associated with quadriceps electrostimulation (16 sessions over 4 weeks; electrically induced contractions of the quadriceps, performed four times a week using an electrostimulator with three surface patch electrodes applied to each quadriceps. ES was performed for > 30 min on both legs simultaneously CONTROL: usual rehabilitation (4 days per week of active limb mobilizations). The strongest patients also performed slow walking on a treadmill and 5 to 10 min of arm-lifting exercise with a 2.5 kg workload. In addition, health education sessions 1 day per week
Outcomes	Maugeri Foundation Respiratory Failure questionnaire (MRF-28), item dyspnea in daily tasks mean (SD) : intervention group before 58 (13), after 4 weeks training 43 (12); control group: before 53 (24), after 4-weeks training 53 (24). Borg scale intervention group pre 6.5 (2.3), post 6.0 (1.5); control group pre 5.0 (2.9), post 6.0 (2.6)
Notes	AUTHORS CONCLUSION: Electrical stimulation can improve quadriceps muscle strength and significantly decrease dyspnea in performing daily tasks

Risk of bias		
Item	**Authors' judgement**	**Description**
Allocation concealment?	Unclear	B - Unclear

Wu 2004

Methods	RCT Oxford Quality Scale 1 to 0 Grade of evidence: IB (IA in 2007) Methodological quality: 14/22 (16/22 in 2007)
Participants	N = 44, COPD FEV1 predicted < 50% in 54.5% Age mean (SD): intervention group 74 years (SD 10.6), control group 74.5 years (SD 10.0) Disease stage: intervention group FEV1 > 70% 9.1%, FEV1 50 to 69% 36.4%, FEV1 < 50% 54.5%, control group FEV1 > 70% 9.1%, FEV1 50-69% 36.4%, FEV1 < 50% 54.5% INCLUSION CRITERIA: COPD; steroids < 10 mg daily; able to walk unassisted; no health problems affecting the progress of COPD; no hospitalisation within last 2 months; no pulmonary rehab within last 6 months; speak Taiwanese or Chinese
Interventions	INTERVENTION: n = 22; acupressure 4 weeks (20 sessions), 16-min sessions five times a week, true acupoints, points were pressed and rubbed once per second. After rubbing or pressing for 5 seconds, they were released for 1 second and then rotated until the treatment time was completed CONTROL: n = 22; sham acupressure 4 weeks (20 sessions), 16-min sessions five times a week, acupoints different from meridians and ganglionic sections of true acupoints, points were chosen which promote intestinal movement and increases intestinal circulation, acupoints were rubbed, pressed and pointed one per second. After rubbing, pressing or pointing for 5 seconds, the pressure was released for 1 second and then rotated until the treatment time was completed
Outcomes	Data collection: questionnaires administered before any treatment given (20 sessions in 4 weeks) PFSDQ-M dyspnea subscale: mean differences in pre- and postscores intervention group (SD): -0.98 (1.41), control group 0.41 (0.43) PFSDQ-M activity subscale: mean differences in pre- and postscores intervention group (SD): -0.39 (0.42), control group 0.28 (0.42) PFSDQ-M fatigue subscale: mean differences in pre- and postscores intervention group (SD): -0.48 (0.82), control group -0.04 (0.37) Second paper (2007) Data collection: questionnaires administered before any treatment given (20 sessions in 4 weeks) Dyspnoea VAS: mean difference true acupressure group -1.60 (1.19), sham acupressure group 0.69 (0.92) Geriatric Depression Scale: mean difference true acupressure group (SD) -2.09 (1.54), sham acupressure group 0.14 (1.61)
Notes	AUTHORS CONCLUSION: dyspnoea scores of the true acupoints acupressure group improved significantly compared with those of the sham group (2004). True acupressure significant improvement of dyspnoea and depression (2007). Study published twice in 2004 and 2007 with different outcome measures

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Wu 2006

Methods	RCT Oxford Quality Scale 1 to 0 Grade of evidence: IB Methodological quality: 18/22
Participants	N = 30, COPD Age mean (SD): intervention group 70.3 (6.1), control group 70.3 (7.4) FEV1% mean (SD): intervention group FEV1% 30.0 (10.8), control group 32.3 (12.2) INCLUSION CRITERIA: diagnoses of COPD, stable disease, no acute exacerbation
Interventions	INTERVENTION: n = 20, 2 weeks breathing training: 3 x/d 15 min. (5 min. panic management, 5 min. pursed-lip breathing, 5 min. diaphragmatic breathing) CONTROL: n = 10, conventional care
Outcomes	Data collection: baseline and after 3 months, VAS on dyspnoea as part of a quality of life scale
Notes	AUTHORS CONCLUSION: dyspnoea improved significantly in the intervention group VAS dyspnoea mean (SD): intervention group baseline 40.6 (25.3), after 3 months 30.7 (17.4), control group baseline 36.4 (16.8), after 3 months 38.3 (15.6)

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Yu 2007

Methods	RCT Oxford Quality Scale 2 to 0 Grade of evidence IA Methodological quality: 17/22
Participants	N = 121, chronic heart failure Disease stage: intervention group NYHA I/II: 59.3%, NYHA III/IV: 40.7%, control group NYHA I/II: 51.6%, NYHA III/IV: 33.9% INCLUSION CRITERIA: to be aged 60 years or older; to be able to communicate; intact cognitive function as indicated by an Abbreviated Mental Test score of 6/10 or higher; to be discharged home EXCLUSION CRITERIA: preexisting psychiatric diagnosis; current use of psychotic medications; prior training or current use of relaxation therapy; pre scheduled cardiac surgery within 6 months of hospital discharge
Interventions	INTERVENTION: Grade 2 progressive muscle relaxation training (PMRT): two 1 h PMRT sessions every week after hospital discharge. First session: nurse taught PMRT, systematically tensing and relaxing 16 muscle groups with a regular breathing pattern to enhance relaxation; the skill was modified by tensing the muscle to three fourths of the full possible tension for a shorter period of 5 sec. to prevent precipitating arrhythmia. Each participant received a PMRT picture guide to facilitate home practice. In the second training session, the participants in turn demonstrated the relaxation technique using the

	taped instructions with the nurse's voice. Participants took the audiocassette tapes home to practice PMRT twice daily throughout the study period. Recording of their relaxation practices in a practice log. Skill revision workshop 4 weeks later to reassess the participants' skill mastery and to discuss their concerns about the PMRT home practice. The interventionist initiated biweekly telephone calls to encourage the participants' compliance and clarify related problems. A telephone record form was developed to record the topics discussed CONTROL: attention-control intervention: the research nurse, who recruited the participants, gave the control group two weekly telephone calls and biweekly thereafter throughout the 14-week study period. The inertness of the attention control intervention was maintained by limiting the conversation to a general greeting. The nurse recorded the topics discussed
Outcomes	Dyspnoea Score Chronic Heart Failure Questionnaire-C mean (SD): intervention group baseline 3.84 (1), 8 weeks 4.68 (0.96), 14 weeks 4.94 (0.83), control group baseline 4.12 (0.91), 8 weeks 4.72 (0.98), 14 weeks 4.7 (0.95)
Notes	AUTHORS CONCLUSION: A medium effect was seen on psychologic distress and a non-significant trend of greater improvement in symptom status (Yu, J Psychosom Research 2007); relaxation therapy was only effective in reducing dyspnoea (Yu, Gerontology 2007). Study published twice.

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	No	C - Inadequate

M = Male
F = Female
pts - Participants
RCT = Randomised Controlled Trial
COPD = Chronic Obstructive Pulmonary Disease
CHF = Chronic Heart Failure
FEV1= Forced expiratory volume in 1 sec.
VAS= Visual analoge scale
NRS = Numerical Rating Scale
UCDS-SOB = University of California St. Diego Shortness of Breath Questionnaire
SGRQ = St. George's Respiratory Questionnaire
CRQ = Chronic Respiratory Questionnaire
HADS = Hospital Anxiety and Depression Scale
ALSFRS-RS = ALS Functional Rating Scale - Respiratory Subscale
BESC = Bronchitis Emphysema Symptom Checklist
PFSDQ-M = Pulmonary Functional Status and Dyspnoea Questionnaire - modified scale
EORTC = European Organisation for Research and Treatment of Cancer
MRC = Medical Research Council
MWT = Minutes Walking Test
DAS = Distractive auditory stimuli
GOLD = Global Iniative for Chronic Obstructive Lung Disease
NYHA = New York Heart Association

HRQL = Health Related Quality of Life
HFCWO = High Frequency Chest Wall Oscillation
NME = Neuromuscular Electronic Stimulator

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Anonymous 1986	not COPD, not advanced disease
Aronoff 1975	not COPD, not advanced disease
AuBuchon 1991	thesis not available
Behera 1998	paper not available
Bianchi 2004	uncontrolled study
Blake 1990	no measurement of breathlessness
Booth 2006	uncontrolled study
Cockcroft 1987	no measurement of breathlessness
Corner 1995	no measurement of breathlessness
Cox 2006	uncontrolled study
Davis 2001	pilot study with evaluation of outcome measures and sample size calculation
Donesky-Cuenco 2006	no data on breathlessness available
Ekman 1998	no measurement of breathlessness
Felber 2003	no subjective measurement of breathlessness
Filshie 1996	uncontrolled study
Gallagher 2006	uncontrolled study
Giardino 2004	exercise training
Giasson 1998	no measurement of breathlessness
Grancelli 2003	no measurement of breathlessness
Hately 2003	uncontrolled study

(*Continued*)

Ingram 1967	uncontrolled study
Klaus 2000	uncontrolled study
Lisansky 1996	no measurement of breathlessness
Littlejohns 1991	no measurement of breathlessness
Maa 2003	not COPD, not advanced disease
McBride 1999	uncontrolled study
Moody 1993	no measurement of breathlessness
Mueller 1970	uncontrolled study
Neff 2003	no measurement of breathlessness
Neuenschwander 2006	uncontrolled study
Petty 1969	no measurement of breathlessness
Pushparajah 2006	uncontrolled study
Roomi 1998	no measurement of breathlessness
Sitzman 1983	uncontrolled study
Smith 1999	no measurement of breathlessness
Stice 1995	quasi-experimental design (no randomisation, patients serve as own controls)
Tandon 1978	no measurement of breathlessness
Thoman 1966	uncontrolled study, no measurement of breathlessness
Thornby 1995	no measurement of breathlessness
Tiwary 1989	no measurement of breathlessness
Wen 1997	not COPD, not advanced disease
Wesmiller 2007	no measurement of breathlessness
White 1999	only abstract, no data of study available
Wilkinson 1999	no measurement of breathlessness

(*Continued*)

Wolkove 2002	study included drugs
Wolkove 2004	study included drugs
Wong 2005	no measurement of breathlessness
Woo 2006	uncontrolled study, no measurement of breathlessness
Yohannes 2003	not advanced disease

DATA AND ANALYSES

This review has no analyses.

ADDITIONAL TABLES

Table 1. Grade of evidence

Grade	Explanation
I	RCT or RCT review
IA	Calculation of sample size and accurate, standard definition of outcome variables
IB	Accurate and standard definition of outcome variables
IC	Neither of the above
II	Prospective study with a comparison group (non-randomized controlled trial, good observational study) or retrospective study with controls effectively for confounding variables
IIA	Calculation of sample size and accurate, standard defintion of outcome variables and adjustment for the effects of important confounding variables
IIB	One or more of the above
III	Retrospective or observational or cross-sectional studies
IIIA	Comparison group, calculation of sample size and accurate, standard definition of outcome variables
IIIB	Two or more of the above
IIIC	None of these

Table 2. Multi-component interventions

Author	Intervention	Profession	Assessment	Counselling/ support	Breathing training	Relaxation	Case management	Psychotherapy	Location
Corner 1996	non-pharmacological intervention	nurse	x	x	x	x			nursing clinic
Bredin 1999	non-pharmacological intervention	nurse	x	x	x	x			nursing clinic

Table 2. Multi-component interventions (*Continued*)

Moore 2002	nurse specialist clinic	nurse	x	x					nursing clinic
Hermiz 2002	community based care	nurse	x	x					home
Ketelaars 1998	specialist training in respiratory disease	nurse		x					home
Goodyer 1995	medication counselling	pharmacist		x					home
Rea 2004	chronic disease management	multiprofessional	x	x					home
McMillan 2007	intervention for caregivers	nurse	x	x					home
Egan 2002	case management	nurse					x		hospital
Rabow 2004	comprehensive care team	multiprofessional		x			x		general medical practice
Hochstetter 2005	breathlessness management	physiotherapist			x				hospital
Wu 2004	breathing training	physiotherapist			x				hospital
Garrod 2005	pursed-lip breathing	physiotherapist			x				hospital
Rosser 1983	psychotherapy	psychoanalyst						x	?

Table 2. Multi-component interventions (*Continued*)

Eiser 1997	psy-chother-apy	psychia-trist			x	x		x	?

APPENDICES

Appendix 1. MEDLINE search strategy

1 exp dyspnea
2 dyspnoea or dyspnea or dyspnoeic or breathing adj3 labour$
3 breathless$.mp.
4 Shortness of breath.mp.
5 Breathing difficult$.mp.
6 or/1-5
7 exp Neoplasms&
8 exp respiratory tract neoplasms
9 exp lung neoplasms
10 lung neoplasm$mp.
11 lung metastas$.mp.
12 Lung cancer.mp.
13 Lung adj3 carcinoma$.mp.
14 or/7-13
15 exp pulmonary disease, chronic obstructive
16 COPD.ab,ti.
17 Chronic obstructive Pulmonary Disease.mp
18 or/15-17
19 exp heart failure, congestive
20 congestive heart failure.mp.
21 chronic heart failure.mp.
22 dilated cardiomyopathy.mp
23 CHF.ab,ti.
24 or/19-23
25 exp pulmonary fibrosis
26 pulmonary fibrosis.mp
27 cryptogenic fibrosing alveolitis.mp.
28 or/25-27
29 exp motor neurone disease
30 MND.ab,ti.
31 ALS.ab,ti.
32 advanced adj3 disease$ or advanced adj3 cancer$ or terminal$ adj3 ill$
33 or/28-31
34 14 or 18 or 24 or 28 or 33
35 Nursing Care
36 nursing care.mp
37 Nursing intervention$.mp

38 exp Respiratory Therapy
39 exp Physical Therapy Techniques
40 exp Exercise movement techniques
41 breathing technique$.mp
42 breathing exercise$.mp
43 physiotherapy.mp
44 fan.mp
45 complementary therapies
46 Complementary therap$.mp
47 complementary medicin$.mp.
48 Alternative medicin$.mp.
49 Alternative therap$.mp.
50 yoga.mp
51 meditation.mp
52 acupuncture.mp
53 acupressure.mp
54 exp musculoskeletal manipulations
55 exp Mind-Body and Relaxation Techniques
56 reflexology.mp
57 relaxation.mp
58 hypnosis.mp
59 exp nutrition
60 exp self-care
61 self-management.mp.
62 exp counseling
63 exp psychotherapy
64 Non-pharmacological intervention$.mp.
65 or/35-64
65 6 AND 34 AND 65

WHAT'S NEW

Last assessed as up-to-date: 4 February 2008.

Date	Event	Description
8 February 2011	Amended	Contact details updated.

HISTORY

Protocol first published: Issue 1, 2006

Review first published: Issue 2, 2008

Date	Event	Description
6 October 2010	Amended	Contact details updated.
6 November 2008	Amended	Further minor changes made to the review to reflect the RevMan 5 conversions
13 May 2008	Amended	Minor typographical edit to the text of the abstract changing the number from 5 to 6 for counselling and support and specifying that there is no evidence for the use of music
13 May 2008	Amended	Converted to new review format.

CONTRIBUTIONS OF AUTHORS

All authors contributed to the development of the idea for this review.

CB: developed and wrote the protocol, conducted the literature searches, searched the titles, collected relevant papers, extracted all studies in to data extraction forms, analysed the papers, drafted the review and finalised it after discussion with the other review authors.

SB: developed the protocol, searched the titles, checked extracted information of studies, discussed outcomes with the other review authors and revised the manuscript.

MG: developed the protocol, extracted some of the studies in to the data extraction form, discussed outcomes with the other review authors and revised the manuscript.

IJH: developed the protocol, checked extracted information of studies, discussed outcomes with the other review authors and revised the manuscript.

DECLARATIONS OF INTEREST

None known

SOURCES OF SUPPORT

Internal sources

- No sources of support supplied

External sources

- The Cicely Saunders Foundation, UK.

INDEX TERMS

Medical Subject Headings (MeSH)

Acupuncture Therapy; Breathing Exercises; Case Management; Dyspnea [etiology; *therapy]; Electric Stimulation Therapy [methods]; Music Therapy; Psychotherapy; Randomized Controlled Trials as Topic; Relaxation Therapy; Vibration [therapeutic use]; Walking

MeSH check words

Humans